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Don't Neglect Grinding Stands and Wheels

Observation of the conditions in a considerable number of railroad shops indicates that the grinding wheels and stands installed for free hand tool grinding are subjected to a great deal of abuse. These machines, although simple, are important and should be carefully selected and properly maintained. If either the stand or the wheel is not in the best of condition it will result in the workmen wasting time and spoiling tools. Grinding wheels cannot operate well unless they are firmly supported, and for that reason the stand should be rigid and equipped with a heavy spindle. A concrete foundation will give added stability and increase the life of the grinding wheels. Granting that the machine has been properly selected and installed, the next care should be to maintain the bearings in alignment without either end or side play.

One of the common mistakes in the use of grinding wheels is the selection of too hard a grade. This is often due to inadequate support for the wheel. If a soft wheel is allowed to vibrate it will wear down very quickly, and for that reason a hard wheel is some times chosen in an attempt to counteract the effects of a poor stand or a good stand improperly installed. On the other hand, hard wheels are sometimes chosen when the only argument in their favor is the increased life secured by their use. Harder wheels require more power to do the same amount of work, cut more slowly than soft wheels and are more apt to burn the tools. The development of grinding processes has undoubtedly been hindered in many railroad shops by the lack of knowledge of the properties of grinding wheels and failure to appreciate the advantages of and the wide field of application for grinding. Some few roads have done notable work in this direction; others should make better use of grinding processes. There is no better way to start than by putting the grinding stands in condition to give efficient service.

Tendencies in Boiler Design

The scientific design of locomotive boilers has developed rapidly in recent years. The tests conducted at Coatesville in 1912 demonstrated the relatively high evaporative value of firebox heating surface and these together with tests made at Altoona provide data which furnish a satisfactory basis for the rational design of boilers of moderate size. Large locomotive boilers, however, require further investigation.

A ratio of length to diameter of approximately one hundred to one is generally recognized as being the most desirable proportion for boiler tubes. If the tubes are lengthened beyond this limit, the heat absorption is increased very little, while the rate of evaporation is decreased and the vacuum required to maintain a given rate of combustion (and consequently the back pressure) is increased. The tubes can, of course, be shortened by making the combustion chamber longer. This sacrifices heating surface and while there is little evidence on which to base an opinion, many locomotive designers feel that it is not advisable to make a combustion chamber more than five feet long. If the length of the combustion chamber is limited to five feet, the tubes in the average Santa Fe or Mountain type locomotive will be about 20 or 21 ft. long. Assuming that 2¼-in. tubes are used, the ratio of length to diameter will be about one hundred and ten to one. Some roads are now using 2½ in. tubes and even larger sizes may prove desirable. As the flame area through the tubes is increased by the larger diameter, it may be advisable to shorten the combustion chamber.

There seems to be no good reason for retaining tubes of 2¼ in. diameter in large modern locomotives; nevertheless the practice is almost universally followed. It is probable that a ratio of length to diameter of approximately one hundred to one would prove the most economical and while the larger tubes needed to maintain this ratio would decrease the heating surface somewhat, they would very likely increase

the boiler capacity. The problem is of great importance and steps should be taken to determine the best proportions for large locomotive boilers.

Eliminate Brake Beam Safety Chains

In glancing through a recent issue of one of the railroad employees' magazines, we were struck by three items telling of station agents who had been commended for noticing dragging brake beams on passing freight trains. These notices are compliments to the alertness of the men in station service, but are also a reflection on the mechanical department. Brake beams are recognized as frequent causes of derailments and thorough terminal inspection cannot prevent occasional failures of the hangers, yet few roads have equipped their cars with adequate safeguards to prevent danger from falling beams. This criticism does not apply to cars built in recent years, as improved safety guards have been used extensively on new equipment since their introduction; but little has been done toward replacing the safety chains which until a few years ago were practically standard equipment. The brake beam safety chain has so many defects that it should be replaced as rapidly as possible, and some standard device for supporting beams in case the hanger fails should be adopted by the Mechanical Section of the American Railroad Association. Such a device should, if possible, be made of materials commonly carried in stock; it should be of substantial construction and not subject to wear by reason of vibration. It would be desirable also to incorporate in it some means for insuring even brake shoe wear and for preventing the bottom brake rod from falling to the track in case the pin by which it is joined to the brake lever should work out.

Why Car Repairs are Behind

In his paper before the Central Railway Club on March 14, J. J. Tatum, general supervisor of car repairs of the Railroad Administration, gave an excellent presentation of the conditions required to bring about a satisfactory car repair situation. As is usually the case, however, the difficulty lies in the practical application of the principles enunciated. It is doubtful if anyone, even though he may have resorted to the practice himself, will attempt to defend the practice of clearing repair tracks by removing bad order cards, but a strict adherence during the war to principles of car maintenance which are generally recognized as correct, would probably have resulted in a complete tie-up of the transportation system within a week. The real crux of the whole situation is a falling behind on the purchase of new cars for renewals and a general lack of sufficient car repair facilities throughout the country.

The business of the railroads is to move traffic, and nothing can be allowed seriously to interfere with this, even temporarily. If traffic is waiting to be moved, cars must be furnished so long as there are any in sufficiently good condition to turn a wheel. There is little hope, therefore, of bringing about an improvement in conditions during a period of unusually heavy traffic movement. The inexcusable feature of the whole situation is the failure to take full advantage of such facilities as are available when conditions permit the release of the cars for heavy repairs.

The lack of facilities was hinted at in Mr. Tatum's paper. While it may be impossible for the Railroad Administration to carry out any extensive plans for increasing facilities, it has already rendered a real service in its campaign for unification of car inspection and repairs by drawing general attention of operating and administrative officers to the needs of the situation. To what extent this will be followed by action, particularly to increase facilities, will depend largely upon the final settlement of the whole railroad problem.

Wheel Arrangement and Boiler Proportions

One of the outstanding features of the Philadelphia & Reading Consolidation type locomotive, a description of which appears elsewhere in this issue, is the tractive effort which has been obtained in relation to the proportions of the boiler which it is possible to place on the 2-8-0 wheel arrangement. The tractive effort of 61,260 lb. has probably been exceeded only by that of the Delaware & Hudson pulverized fuel burning Consolidation type locomotive built three years ago, which is 61,400 lb. For heavy drag service, which the engines are designed to handle, it is apparent that tractive effort at slow speeds is relatively of greater importance than high sustained horsepower capacity at the speeds coincident with the maximum horsepower rating of the locomotive, and under such conditions the reduced first cost and maintenance which may be expected from the absence of a trailer are worthy of consideration. It is only on this basis that the sacrifices in boiler capacity with this wheel arrangement can be justified.

But considering the boiler of this locomotive alone, entirely aside from its relation to the cylinder capacity, the use of tubes 13 ft. 6 in. long appears to be shorter than is demanded for the highest efficiency. The best ratio of length to diameter of tubes, considering both capacity per unit weight and efficiency, is 100. With 2-in. tubes, which are in use on the Philadelphia & Reading locomotive, the ratio of length to diameter is 81, a considerable reduction from the generally accepted ratio. The sacrifice in tube length is partially accounted for by the inclusion of a combustion chamber, which is desirable for the best results in getting the heat out of the fuel, but it is evident that with the short tubes this will be partially offset by a loss of efficiency due to the higher front end temperatures. It is doubtful whether the best results, from the standpoint of efficiency, any more than from the standpoint of capacity, can be obtained with the 2-8-0 type, with tubes of the usual diameters.

Keep up Standards on New Work

The failure of Congress to pass the bill authorizing the appropriation which the Railroad Administration requested makes it necessary to curtail expenses until another revolving fund is provided. This unfortunate financial condition is already affecting the expenditures for improvements and has brought work on many partially completed projects to a standstill. Under these circumstances there is a powerful temptation to complete unfinished installations with the least possible additional outlay and it may not be out of place to sound a warning against the purchase of cheap equipment in order to stretch the appropriations.

There is often a noticeable tendency on railroads to give more consideration to first cost than to the cost of operation, due probably to the fact that requisitions are handled by purchasing officers who are interested in securing low prices but have little conception of the suitability of the equipment they purchase, or the great differences in the cost of operation that may exist between apparently similar types. Under present conditions, when it is difficult to secure authority for expenditures, railroad men are apt to figure their minimum requirements and accept facilities which their judgment tells them will prove wasteful in the end. There is every reason to believe that the traffic on railroads in this country will increase as rapidly in the future as it has in the past and that the motive power and rolling stock will continue to grow larger. Facilities which meet present requirements with little excess capacity for future demands are almost sure to prove inadequate in a few years. In the end it is more important that whatever is done be done right, than that a greater number of things be done in a half-hearted way.

There seems to be no question that the railroads will soon be given sufficient revenues to enable them to make the needed

extensions to their properties. For that reason, it is advisable to make the best of present facilities for the time being with a view to making all improvements adequate to take care of future requirements. Whether it is a matter of adding to shop facilities or improving locomotives or cars, the mechanical department officers must realize the importance of choosing the course that will in the end prove the most economical and of standing firmly by the decision in spite of the obstacles with which they are confronted at the present time.

The Mechanical Associations

The convention season is fast approaching and railway mechanical department officers and foremen are giving much thought to the problem of the future welfare and development of the various railway mechanical department associations. The two major organizations, the American Railway Master Mechanics' Association and the Master Car Builders' Association, under the new order of things will be combined into the Mechanical Section of the American Railroad Association. Except that the names of the two organizations will be discarded and their efforts will be combined, it would appear that there is no reason why the good work that they have done in the past should not go steadily forward but at a faster pace. While these two associations have made many recommendations in the past, it has been impossible to make them generally effective, except insofar as the various roads subscribed to the Master Car Builders' rules of interchange. It has been suggested many times that the recommendations of the two associations should be passed on and approved by the American Railway Association but even that organization has had no way of generally enforcing its recommendations. The new organization provides that the various sections should report direct to the American Railroad Association and that its recommendations in turn should go to the Railroad Administration which has the power to make them effective throughout the roads under its control.

It is, of course, somewhat of a question as to just what will happen when the railroad properties are returned to the private managements, but it would seem that some steps should be taken to the end that the American Railroad Association should have authority to put into effect such recommendations as may be made to it by its various sections after full investigation, study and discussion, and which in turn receive the approval of the higher organization. If this can be done, then the amalgamation of the two major mechanical associations as a section of the American Railroad Association promises to add very greatly to the importance of such work as may be done by the Mechanical Section.

A careful study of the constitution and by-laws indicates that the different sections of the American Railroad Association will be left to work out their problems largely in their own way and there appears to be no good reason why any of their past methods or practices should be upset, provided they have been found effective. Regardless of what the future may hold, however, the mechanical department officers and foremen should make every possible use of the opportunity that lies before them in demonstrating their ability to meet the larger problems that now confront them. The past three years have brought vividly before the higher executive officers the importance of the equipment and maintenance situation. If a mechanical man proves that he is a master of those things which come within his province, he is bound to be listened to with attention. The great difficulty is that many of the mechanical department officers have allowed their lights to be hidden under a bushel and it is not strange that in some cases they have not inspired confidence on the part of their superiors. They have a great opportunity to overcome this deficiency at the present time.

Just what disposition is to be made of the minor mechanical department associations does not as yet appear. It would seem wise, however, that they should be allowed to preserve their individuality but that some channel be provided so that their findings will automatically go to the Mechanical Section of the American Railroad Association and either be approved and made standard or recommended practice, or be referred back to the minor organizations for further consideration. One great handicap to the minor mechanical organizations has been that they have lacked in official recognition and although their work has been a great help and inspiration to the members and to those who have followed their proceedings closely, their recommendations and findings have not had the force that they should have had. It may be well to more clearly define the exact field and limitations of each of the associations in order that the entire mechanical department be covered by these minor organizations and that there be no overlapping.

Thus far the Railroad Administration has asked the managements of the different roads to see that as many of the members of the various organizations as possible be sent to the conventions. Apparently, this practice is to be continued, at least in the case of all of the associations that receive the approval of the Administration. The result will be that the attendance in all cases will be larger and more representative than it has been in the past and this should do much to encourage the officers and committee chairmen in putting forth extra efforts to make the meetings of the very greatest possible value.

The reports and papers for the June mechanical conventions are being rapidly turned in to Secretary Hawthorne, and it is expected that all of them will be in the hands of the members at a much earlier date than usual. The conventions will be watched more closely and critically than ever before and every member should take a pride in going to Atlantic City prepared to discuss the reports intelligently and with the idea of going back to his home road prepared to advocate and make effective those things that are developed at the convention that seem to him to be of the greatest practical value. Officers at the head of the mechanical departments should encourage their subordinates in this respect and will do well to ask for a written report of recommendations from each one who attends the meetings. This will tend to encourage the men to crystallize their thoughts and findings and will add much to the returns that may be expected from the conventions.

NEW BOOKS

Mechanism of Combustion. By J. T. Anthony, vice-president, American Arch Company, New York. 24 pages, 8 in. by 10½ in., illustrated, bound in paper. Distributed by American Arch Company, 30 Church street, New York.

The American Arch Company is issuing a series of bulletins dealing with the subject of combustion and the transfer of heat, of which the bulletin on The Mechanism of Combustion is the second. This bulletin presents in a very clear manner the various processes that take place in the combustion of coal. It explains the molecular construction of fuel and shows just what transformations occur in its combustion and why they occur. In other words, a very well merited attempt is made to explain the "mechanism" of combustion. The illustrations included in the pamphlet serve as a tremendous aid to the reader in visualizing the chemical processes of combustion. The pamphlet also shows where and how the heat is generated from fuel by the process of combustion. It discusses first the structure of atoms and molecules and explains the hydrocarbon molecules which are found in fuel. It explains the action of these atoms and molecules in the coal in both the quiescent and active (when the coal is burning) state. It fully explains why and how the heat is obtained. The pamphlet is strongly recommended to those desiring to learn more of the secrets of the combustion of coal.

COMMUNICATIONS

INADEQUATE MAIN BOXES

Brooklyn, N. Y.

To the Editor:

The communication from J. H. Buck on the subject of "Inadequate Main Boxes," published in your issue of March, 1919, calls attention to a defect which has developed very rapidly in large modern locomotives. The writer does not agree with Mr. Buck that larger boxes and bearings would remedy the evil. An extension of bearing surface toward the neutral axis of the locomotive has not even proved palliative and an enlargement of journal diameter is open to the objection that the increased surface velocity of the journal might cause heating.

In order to call attention to some ratios which seem to have been neglected in modern locomotive design, the writer has prepared the table, embracing characteristics of four types of locomotives, namely, four-coupled, six-coupled, eight-coupled and ten-coupled. The writer has chosen a maximum static rail load of 30,000 lb. per wheel, and in order to make driving box conditions as nearly comparative as possible this load, the boiler pressure, the piston stroke and driving wheel diameter have been assumed as alike in each instance. The tractive effort is based on a factor of adhesion of four and appropriate cylinder diameters have been derived from the data.

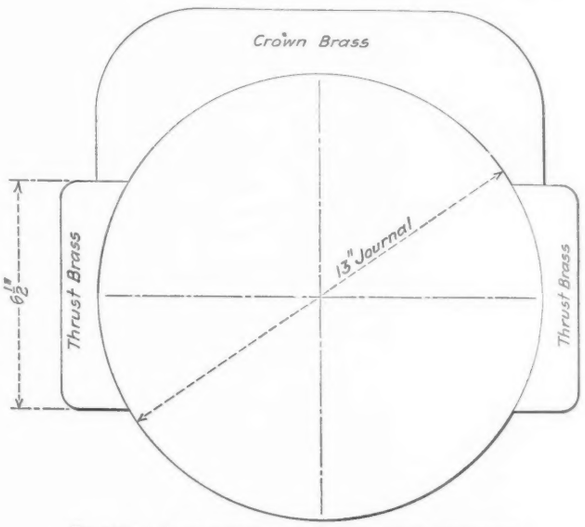
From the cylinder areas and boiler pressure, piston thrusts are derived. Journal sizes corresponding to current practice are given. In the table, line 4 has been derived from line 3 by subtracting the dead weight of one-half the axle, the wheel, the crank-pin and the attached rods. By reason of the fact that these weights are somewhat greater in the ten-coupled than in the four-coupled engines the live loads carried by the journals are less in the ten-coupled engine than in the four-coupled. The vertical bearing pressures

1—Number of driving wheels.....	4	6	8	10
2—Total weight on driving wheels, lb.	120,000	180,000	240,000	300,000
3—Weight on each driving wheel, lb..	30,000	30,000	30,000	30,000
4—Live load on each main journal, lb.	27,500	27,235	26,950	26,650
5—Tractive effort (ratio of adhesion = 4), lb.	30,000	45,000	60,000	75,000
6—Boiler pressure, lb. per sq. in.....	200	200	200	200
7—Piston stroke, in.....	30	30	30	30
8—Diameter of driving wheels, in....	63	63	63	63
9—Cylinder diameter (derived), in...	19¼	23⅝	27⅛	30½
10—Piston thrust, lb.....	57,454	87,672	115,574	146,124
11—Size of journals, dia. and length, in.	10x15	11x15	12x15	13x15
12—Vertically projected area of bearings, sq. in.	150	165	180	195
13—Horizontally projected area of bearings, sq. in.	75	82½	90	97½
14—Vertical bearing pressure, lb. per sq. in.	183	165	149	136
15—Horizontal bearing pressure, lb. per sq. in.....	766	1,062	1,284	1,498
16—Line 10 divided by line 4.....	2.08	3.22	4.29	5.48

per square inch are obtained by dividing the figures in line 4 by those in line 12. Line 13 is based on the assumption that the bearing embraces only the upper half of the journal. The horizontal bearing pressures are obtained by dividing the figures in line 10 by those in line 13.

A perusal of the figures in line 14 (vertical bearing pressures) and line 15 (horizontal bearing pressures) reveals some interesting information. The vertical bearing pressures per square inch have decreased progressively as the size of the locomotive has increased, owing to the fact that the journal dimensions have increased, while the live load carried has slightly decreased. The horizontal bearing pressures due to piston thrusts have increased progressively with the increase of locomotive capacity. In other words, the bearings of the ten-coupled engine will wear in the vertical direction only 75 per cent as fast as will those of the four-coupled engine, while in the horizontal direction the bearings of the ten-coupled engine will wear 194 per cent as fast as those of the four-coupled engine. Thus, it will be seen that the tendency of the bearings to wear open at the points will be greater in the ten-coupled engine. That these are facts and that the effect is as described, no one can deny. The foregoing relates entirely to friction and wear.

In line 16 we find a ratio which, to the writer's knowledge, has never been used. This is the ratio between the piston thrust and the pressure downward which holds the bearing on the journal. During the writer's experience as a locomotive engineer he handled a class of heavy tandem compound ten-coupled engines. When working at full capacity these engines raised the main boxes from their journals. So pronounced was this tendency to rise that it caused an epidemic of broken oil cellars, which was cured only by increasing the clearance between the journal and the cellar. This would make it appear that the half-shell brass is, in effect, an inclined plane the angle of which depends upon and varies with the weight on the journal and the piston thrust. Somewhere in the range of the writer's table the

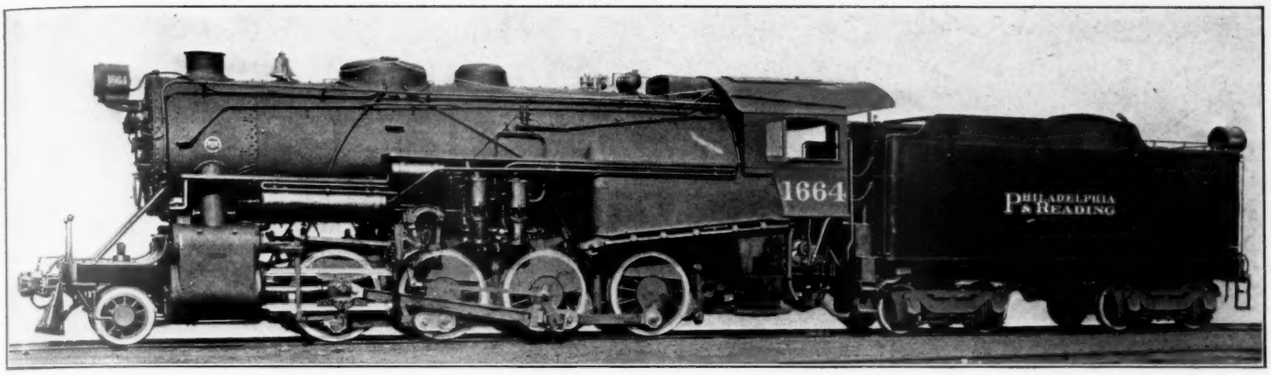


Proposed Arrangement of Driving Box Bearings

critical angle at which the box tends to rise from the journal could, no doubt, be found by experiment. It would probably be quite difficult to determine this angle mathematically, but the remedy is easily determined.

It is the writer's opinion that this tendency to rise is the principal reason for the rapid deterioration of main boxes in heavy power and that the only real remedy lies in providing bearing surface below the center line of the journal, as shown by the sketch submitted. By this means a horizontally projected bearing area 50 per cent greater than that ordinarily provided may be obtained. Such an increase would reduce the horizontal bearing pressure from piston thrust in the ten-coupled engine to 999 lb. per sq. in., which would probably vastly improve the wearing qualities. The tendency to rise from the journal would also be overcome.

Such a re-arrangement of the bearing surfaces would involve a radical departure from present practice, but it can be done, and there is no good reason for adherence to the antiquated half-shell bearing which has been long since outgrown. The heavy stationary engine has quarter boxes in which the bearing entirely encircles the journal and the brasses are adjustable in all directions for wear, while modern locomotives must get along with the half-shell non-adjustable boxes of seventy-five years ago. It would seem that a discussion of the points referred to in this letter might develop something of interest. Charles F. Prescott.



Heavy Consolidation Type Locomotive Built for the Philadelphia & Reading

P. & R. Large 2-8-2 Type Locomotive

Tractive Effort is 61,260 lb.; Boiler has a Combustion Chamber and 2-in. Tubes 13 ft. 6 in. Long

THE Philadelphia & Reading has recently received from The Baldwin Locomotive Works a number of Consolidation type locomotives which are notable for their weight and hauling capacity, and also because they are the only engines built to a railroad company's design to be included in the Railroad Administration orders last year.

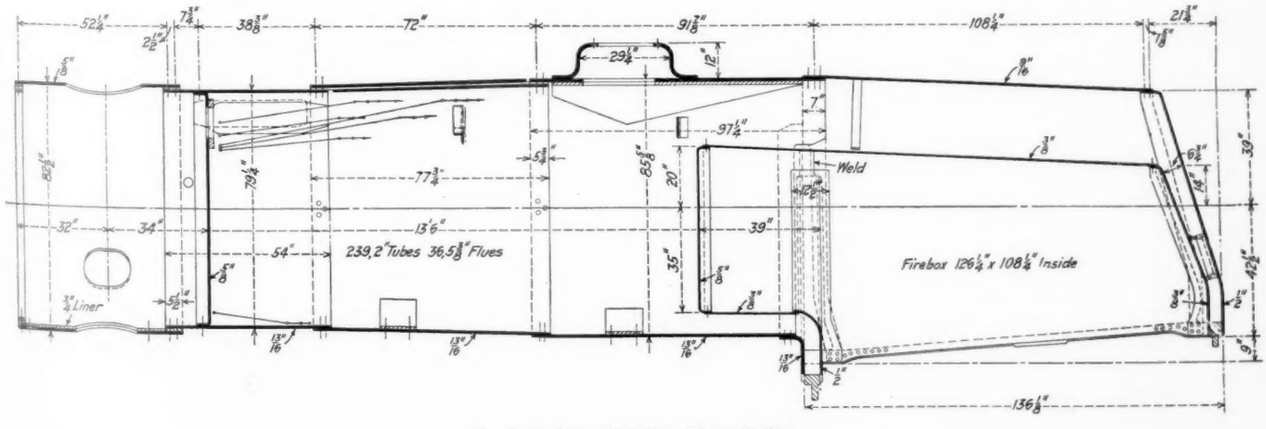
In the table will be found a comparison of the leading dimensions of these locomotives with the first Baldwin Consolidation type built for the Philadelphia & Reading:

Date built	Cylinders, in.	Drivers, diam., in.	Steam pressure lb. per sq. in.	Grate area, sq. ft.	Water heating surface, sq. ft.	Superheating surface, sq. ft.	Weight on drivers, lb.	Total weight, lb.	Tractive effort, lb.
1880.....	20 x 24	50	120	76	1,357	...	90,000	104,000	19,600
1918.....	25 x 32	55½	200	94.9	2,655	575	250,800	281,100	61,200

The locomotives built in 1880 had boilers of the Wootten type, equipped for burning fine anthracite, and this same type of boiler in a somewhat modified form and of greatly enlarged dimensions, is used in the new design. The fuel generally used today consists of a mixture of fine anthracite and bituminous coal, and this is burned on a rocking grate, instead of on a combination of water tubes and pull-out bars, as applied to the earlier locomotives.

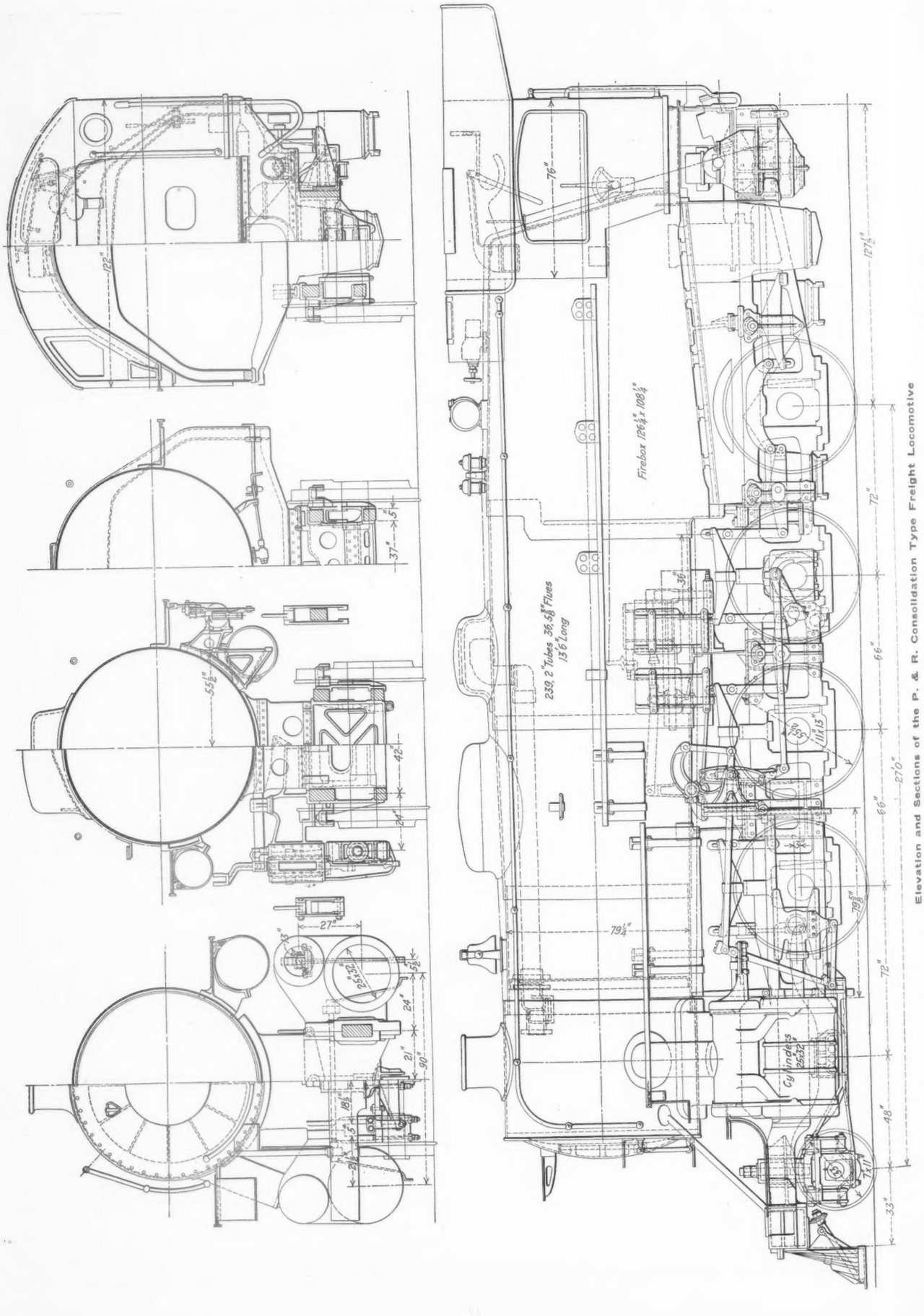
The new locomotives are designed for heavy drag service, and are in many respects similar to a group of Mikado type locomotives which preceded them. In consideration of the kind of fuel used, however, and the relatively small diameter of the wheels, a firebox of sufficient depth can be placed above the rear drivers without raising the boiler center to an excessive height. In the new Consolidations, the boiler center is placed 9 ft. 7½ in. above the rail.

In the following table will be found a comparison of the principal dimensions and ratios of the Consolidation and Mikado types. It will be seen that the new locomotives have smaller driving wheels and lower boiler pressure than the Mikados, but the cylinders are one inch larger in diameter and they have a starting tractive effort almost 4,000 lb. greater than the Mikados. It is evident that there is a considerable sacrifice in heating surface; there are eight less superheater units and 20 less tubes, and they are 4 ft. 2 in. shorter than those in the Mikado type boiler. The difference in grate area is less marked. For heavy drag service, however, high tractive effort at slow speeds is the controlling factor rather than a high sustained horsepower capacity.



P. & R. Consolidation Type Boiler

The boiler has a conical ring in the middle of the barrel, which increases the diameter from 79¼ in. at the first ring to 85⅝ in. at the throat. The firebox has a combustion chamber 39 in. long, and a brick wall 26 in. high is built across the throat of the chamber. Flexible bolts are used almost exclusively in the water legs, and four rows of ex-



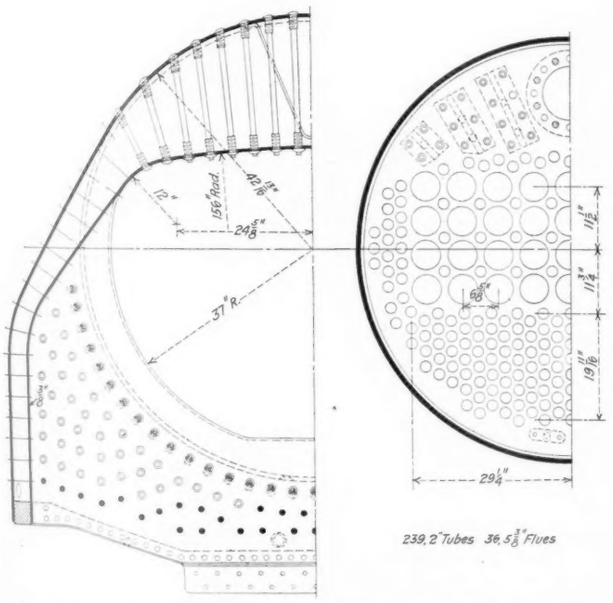
Elevation and Sections of the P. & R. Consolidation Type Freight Locomotive

pansion stays support the front of the crown. The firebox has two oval fire-door openings, and the doors are power operated. A Standard stoker is applied. The mud ring is single riveted, except at the corners, where it is increased in depth to take two rows of rivets. A four-hopper ash-pan is applied with the two rear hoppers back of the wheels outside the frames. The equipment includes a power grate shaker.

The smokebox is comparatively short, and is equipped with the Economy front end arrangement,* and patented I. A. Seiders, superintendent of motive power and rolling equipment of the railroad. A special feature of this arrangement is a breaker plate, which consists of a slotted plate

COMPARISON OF P. & R. CONSOLIDATION AND MIKADO TYPE LOCOMOTIVES

Type	2-8-0	2-8-2
Tractive effort, lb.	61,260	57,320
Total weight, lb.	281,100	329,300
Weight on drivers, lb.	250,800	246,600
Diameter of drivers, in.	55½	61½
Cylinders, diameter and stroke, in.	25 by 32	24 by 32
Steam pressure, lb. per sq. in.	200	225
Heating surface, total evap., sq. ft.	2,655	4,224
Heating surface, equivalent, sq. ft.	3,518	5,264
Grate area, sq. ft.	94.9	108
Tractive effort x dia. drivers ÷ equiv. heating surface	966.5	669.7
Firebox heating surface ÷ equiv. heating surface, per cent	8.4	6.2
Grate area ÷ vol. cylinders	5.2	6.4



Half Section Through the Wootten Firebox and Half Tube Sheet Layout

fitted with deflecting vanes. This plate is placed under the superheater damper and in front of the tubes, and is very effective in breaking up the large sparks before they strike the netting. The netting frames are most substantial in construction, and the device has proved effective in preventing the setting of fires due to escaping sparks.

The cylinders are cast separate from the saddle, the right and left hand cylinders being interchangeable. They are made without bushings, and have barrel walls 2¼ in. thick. The cylinder castings and central saddle are made with suitable recesses through which the frames pass. The frame at this point has a single section, 5 in. wide by 13 in. deep—and the cylinder, frame and saddle are held together on each side by a total of 59 horizontal bolts, 1⅛ in. in diameter. The saddle and cylinders are keyed to the frames at the front by vertical keys. The valve motions are of the Walschaert type, and are controlled by the Ragonnet power reverse gear.

The frames are of most substantial construction. They have a depth of 7½ in. above the pedestals, and the pedestal binders are held in place by three bolts in each end. The main pedestal wedges are self-adjusting. Strong transverse braces of cast steel are applied to the frames between adjacent pairs of driving-wheels. The brace back of the main drivers supports sliding bearings, which carry the front end of the mud ring. The rear end is supported by an expansion plate.

The cab, in accordance with the most recent practice for Wootten boiler locomotives on this road, is placed at the rear end instead of over the middle of the barrel. The sides of the cab are cut away in front in order to permit easy access to the stay-bolts.

Further particulars are presented in the following table of dimensions and data:

General Data

Gage	4 ft. 8½ in.
Service	Freight
Fuel	Hard and soft coal, mixed
Tractive effort	61,260 lb.
Weight in working order	281,100 lb.
Weight on drivers	250,800 lb.
Weight on leading truck	30,300 lb.
Weight of engine and tender in working order	462,000 lb.
Wheel base, driving	17 ft.
Wheel base, total	27 ft.
Wheel base, engine and tender	63 ft. 11 in.

Ratios.

Weight on drivers ÷ tractive effort	4.1
Total weight ÷ tractive effort	4.6
Tractive effort × diam. drivers ÷ equivalent heating surface*	966.5
Equivalent heating surface* ÷ grate area	37.1
Firebox heating surface ÷ equivalent heating surface,* per cent	8.4
Weight on drivers ÷ equivalent heating surface*	71.3
Total weight ÷ equivalent heating surface*	79.9
Volume both cylinders	18.2 cu. ft.
Equivalent heating surface* ÷ vol. cylinders	193.5
Grate area ÷ vol. cylinders	5.2

Cylinders.

Kind	Simple
Diameter and stroke	25 in. by 32 in.

Valves

Kind	Piston
Diameter	13 in.

Wheels

Driving, diameter over tires	55½ in.
Driving, thickness of tires	6½ in.
Driving journals, diameter and length	11 in. by 13 in.
Engine truck wheels, diameter	33 in.
Engine truck, journals	7 in. by 11 in.

Boiler

Style	Wootten conical
Working pressure	200 lb. per sq. in.
Outside diameter of first ring	79¼ in.
Firebox, length and width	126¼ in. by 108¼ in.
Firebox plates, thickness	Sides, back and crown, ⅜ in.; tube, ⅝ in.
Firebox, water space	Front, 5 in.; sides and back, 4 in.
Tubes, number and outside diameter	239—2 in.
Flues, number and outside diameter	36—5⅜ in.
Tubes and flues, length	13 ft. 6 in.
Heating surface, tubes and flues	2,359 sq. ft.
Heating surface, firebox†	296 sq. ft.
Heating surface, total	2,655 sq. ft.
Superheater heating surface	575 sq. ft.
Equivalent heating surface*	3,518 sq. ft.
Grate area	94.9 sq. ft.

Tender

Tank	Water bottom
Wheels, diameter	36 in.
Journals, diameter and length	6 in. by 11 in.
Water capacity	9,500 gal.
Coal capacity	15 tons

*For description and illustrations of this device see the *Railway Mechanical Engineer* for February, 1918, page 118.

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

†Includes combustion chamber.

Elevation and Sections of the P. & R. Consolidation Type Freight Locomotive

RAILROAD ADMINISTRATION NEWS

Shop Crafts Present Demands for Further Wage Increases; Orders of the Regional Directors

TWO representatives of each regional director and an equal number of representatives of the Brotherhood of Maintenance of Way Employees and Shop Men began a meeting at Washington on March 10 for the purpose of recommending to the Board of Wages and Working Conditions a set of uniform rules governing working conditions. A tentative draft was submitted to the board by the brotherhood some time ago.

DIVISION OF FINANCE AND PURCHASES REORGANIZED

John Skelton Williams has resigned as director of the Division of Finances and Purchases of the Railroad Administration, effective March 15, and the division has been divided into two new ones, the Division of Finance and the Divison of Purchases. Swagar Sherley, chairman of the House Committee on Appropriations in the Sixty-fifth Congress, who had charge of the railroad appropriation bill which passed the House, has been appointed director of the Division of Finance, effective about April 15, and Henry B. Spencer, formerly chairman of the Central Advisory Purchasing Committee, has been appointed director of the Division of Purchases. For the time being, Director General Hines will himself direct the work of the Division of Finance with the assistance of the associate director of the Division, Charles B. Eddy.

Mr. Williams is now chairman of an advisory finance committee, which will be expected to submit to the director general from time to time its advice on matters of financial policy and also to make to the director general preliminary reports on any proposed reorganizations which may require his approval. He is also chairman of an advisory committee on purchases, the other members of which are Robert S. Lovett, president of the Union Pacific, and Henry Walters, chairman of the Atlantic Coast Line. This committee will submit to the director general from time to time its advice regarding matters of policy with respect to purchases and for that purpose is authorized to make the necessary investigations.

Circular No. 1 of the Division of Purchases announces that Samuel Porcher and George G. Yeomans, heretofore members of the Central Advisory Purchasing Committee, are appointed assistant directors of the Division of Purchases, and William W. Morris, heretofore secretary of the Central Advisory Purchasing Committee, is appointed assistant to the director, Division of Purchases.

H. C. Pearce, manager, Procurement Section; M. E. Towner, manager, Forest Products Section; E. J. Roth, manager, Stores Section; and B. P. Phillippe, fuel distributor heretofore reporting to the chairman of the Central Advisory Purchasing Committee, will report to the director of the Division of Purchases.

WAGE DEMANDS FOR 1919

Now that most of the back pay for 1918 has been taken into the accounts, the processes which are expected to result in a new series of retroactive payments for 1919 are still being continued. The request of the train service brotherhoods for an upward revision of their wage scales and time and one-half for overtime is still pending, on a recommendation of the Board of Wages and Working Conditions which is before the director general for a decision. The award when issued is expected to be retroactive to January 1, and the shop employees have asked for a new increase to become effective as of the same date.

A letter addressed to the director general by B. M. Jewell, acting president of the railway employees' department of the American Federation of Labor, and the executives of the individual organizations, says that great dissatisfaction has been manifested by the machinists, blacksmiths, boilermakers, sheet metal workers, electricians and car men, regular and helper apprentices and helpers, "due to the present inadequate wage rates," as contained in the awards made in 1918, and they desire to present a request for further increase "to place them in a position to meet the ever-rising cost of living and maintain a more equal differential between classes of railroad employees and those engaged in a similar capacity in other industries." The letter states that these employees have been very insistent in their demands for some time, but the request has been withheld until they have become so persistent that it has been deemed advisable to comply with their wishes. The letter also urges upon the director general the necessity of arranging a conference with the representatives of the shop crafts for the purpose of arriving at a thorough understanding of the award to be issued covering this request, prior to the issuance of the general order.

The new scale of rates requested provides for a minimum hourly rate of 85 cents an hour, as compared with the present minimum of 68 cents, for machinists, blacksmiths, sheet metal workers, electrical workers, car men and boilermakers, a minimum hourly rate of 60 cents an hour for helpers, and differentials above the minimum hourly rate for certain classes of employees. Machinists working on valve motion work, tool room work, rod work, heavy machine operators, layers out, air men and federal inspection men ask an excess of 6 cents an hour above the machinists' rate. Certain classes of boilermakers ask an excess of 6 cents above the boilermakers' rate. Blacksmiths employed as hammersmiths and electricians employed as armature winders ask an excess of 25 cents above the rate for the respective crafts, making their rates $1.10 an hour.

The request provides that general foremen, foremen, assistant foremen, and leaders shall be paid on an hourly basis and receive overtime compensation for all services rendered in excess of eight hours per day, with a minimum hourly rate of $1 for general foremen, 95 cents for foremen, and 90 cents for assistant foremen, gang foremen and leaders; provided that all rates in excess of these shall be continued and monthly rates now in effect shall be the basis for establishing the hourly rates, the monthly rates to be divided by 200 to obtain the hourly rate.

The request also provides that operators of electric, acetylene thermit or other improved welding processes or machines shall receive an hourly rate of 91 cents, that all employees performing the recognized work of any craft who have had one year's experience or less shall receive 67 cents an hour, who have had one year or less than two years' experience shall receive 70 cents an hour, two years' and less than three years', 74 cents an hour, over three years' and less than four years', 79 cents an hour. This does not include regular and helper apprentices. It is provided that should any of the above leave the service, employees with not less than four years' experience shall be assigned to their positions and paid the minimum rate. Regular and helper apprentices assigned in connection with the work of their respective crafts are to receive as a starting rate 35 cents an hour, with an increase of 2½ cents an hour for each six months up to and including the first three years, and an increase of 5 cents an hour for

the first six months of the fourth year and 7½ cents an hour for the last six months of the fourth year.

INVESTIGATION OF THE WILLIAM H. WOOD FIREBOX

The William H. Wood corrugated locomotive firebox is the subject of a report recently made by Frank McManamy, assistant director, Division of Operation, United States Railroad Administration, by a sub-committee of the Committee on Standards and published by the Railroad Administration. The committee made a thorough investigation of the service records of the five fireboxes of this construction actually applied to locomotives and examined the fireboxes, now all replaced by others of standard design. Its conclusions are "that the Railroad Administration should not apply any of these fireboxes for the following reasons:

"That the economy claims have not been proven.

"That the life to be expected, based on the best performances is very much less than that of the ordinary form of box.

"That the time out of service will be very much greater than with the ordinary box."

The committee does not believe that there is sufficient advantage in this form of construction to compensate for the added difficulty and expense involved in its repair and renewal.

OBLIGATIONS OF THE RAILROAD ADMINISTRATION FOR EQUIPMENT ORDERED IN 1918* WITH UNIT PRICES OF CARS AND LOCOMOTIVES

THE STANDARD LOCOMOTIVE ORDERS
RECAPITULATION

Number	Type	Price	Amount
150	Light switchers	$36,029.00	$5,404,350.00
50	Light switchers	38,416.33	1,920,816.50
150	Heavy switchers	43,966.00	6,594,900.00
150	Heavy switchers	46,199.03	6,929,854.50
43	Light Pacific	50,867.00	2,187,281.00
25	Light Mikado	57,178.25	1,429,456.25
530	Light Mikado	53,619.00	28,418,070.00
150	Light Mikado	60,613.27	9,091,990.50
20	Heavy Pacific	53,924.00	1,078,480.00
35	Light mountain	56,995.00	1,994,825.00
217	Heavy Mikado	56,761.00	12,751,137.00
50	Heavy Mikado	63,686.90	3,184,345.00
5	Heavy mountain	61,929.00	309,645.00
150	Light Santa Fe	62,277.00	9,341,550.00
20	Light Santa Fe	68,918.16	1,378,363.20
50	Heavy Santa Fe	67,543.00	3,377,150.00
5	Heavy Santa Fe	73,395.81	366,979.05
100	Light Mikado	60,486.00	6,048,600.00
30	Light mallet	78,339.00	2,350,170.00
20	Heavy mallet	92,195.00	1,843,900.00
75	Heavy mallet	98,155.60	7,361,670.00
30	Consolidation	53,619.00	1,608,570.00
2,055			$114,972,103.00

CONTRACTS FOR 100,000 STANDARD CARS
RECAPITULATION

Number	Type	Price	Amount
20,000	C. G.	$2,697.20	$53,944,000.00
25,000	Hopper	2,916.67	70,416,750.00
25,000	D. S box	2,918.88	72,972,000.00
25,000	S. S. box	3,050.05	76,251,250.00
5,000	70-ton	3,173.89	15,869,450.00
100,000			$289,453,450.00
Balance due on locomotives			$74,370,918.62
Balance due on cars			212,266,942.37
Total			$286,637,860.99

*These obligations become due as the equipment is delivered.

POSTERS TO ILLUSTRATE FIRING METHODS

The Fuel Conservation Section has prepared two colored posters showing the interior of a locomotive firebox for the purpose of illustrating the effects of irregular firing methods, to be posted in roundhouses, foremen's offices, Y. M. C. A. buildings and other places where they may readily come to the attention of railroad enginemen. The method of illustration was employed in the presentation of a paper by D. C. Buell on "The Proper Method of Firing Locomotives" at the fourth annual convention of the International Railway Fuel Association and was amplified and enlarged upon by the University of Illinois engineering experiment station in a circular from which the illustrations now used were taken.

SAFE HANDLING OF OXY-ACETYLENE APPARATUS IN SHOPS

Form I F-12 has been issued under date of February 15, by The Fire Loss and Protection Section in which are reproduced the recommendations and instructions for the safe handling of oxy-acetylene apparatus in shops contained in a paper * by E. Wanamaker, electrical engineer of the Rock Island Lines at the last annual meeting of the Railway Fire Protection Association. These recommendations have been approved by the Association and authorized to be issued as its Bulletin No. 17.

RENTAL CHARGES FOR DINING CARS, LOCOMOTIVE AND WRECKING CRANES

The director general has approved a schedule of rental charges to be applied between railroads for dining cars, locomotive cranes and various classes of work equipment, effective as of March 1. The following were taken from the list:

	Rate per day
DINING CARS: Furnished (except provisions)	$40.00
LOCOMOTIVE CRANES:	
Five tons capacity or less	15.00
Over 5 tons capacity and less than 20 tons capacity	20.00
Over 20 tons capacity	25.00
WRECKING CRANES:	
Steam wrecking cranes, 75 tons capacity and less	40.00
Steam wrecking cranes, capacity more than 75 tons	55.00

ORDERS OF REGIONAL DIRECTORS

International Railway Fuel Association.—The regional director, Eastern region, by file 1301-28A584, advises that the director of the division of operation desires a large attendance of railroad fuel men at the International Railway Fuel Association's annual meeting, at Hotel Sherman, Chicago, May 19, 20, 21 and 22. The convention will discuss the conservation of railroad fuel coal, and railroad fuel men ought to attend regardless of whether or not they hold membership in the association. Federal managers are asked to see that their lines are properly represented, more particularly by men connected with the transportation and mechanical departments; such delegates to go prepared, as far as possible, to take an active part in the work of the convention. The Southern regional director, file 520-6, and the Northwestern director make the same request.

Lettering of Locomotives.—The Eastern and the Southwestern Regional Directors have announced that on locomotives ordered by the director general for individual roads, and which are paid for by the roads, the letters "U. S." need not be shown on the engines or tenders.

Rental Rate for Locomotives.—The regional director, Eastern region, by file 500-1-3A555, prescribes the rental rate for locomotives as one mill per pound of tractive power per day, with a minimum of fifteen dollars a day. This cancels the circular, file 3000-42, of March 12, 1918. The Northwestern, Southwestern and Southern regional directors have issued similar orders.

Report of Classified Locomotive Repairs.—The Southwestern regional director in Order 172 announces the adoption of Form MD-34 for uniform reports of locomotives receiving classification repairs. This report is mailed monthly to Frank McManamy, Washington, and a copy is sent to the regional director.

Liberal Motion Devices and Removable Driving Box Brasses.—In order to secure current data for the Committee of Standards relative to the performance of these two devices, the Eastern regional director, file 500-71A608, has issued blank forms calling for the number of locomotives equipped, date equipped, and maintenance costs per mile in each case, compared with an equal number of locomotives of the same class and in the same service not so equipped. For the lateral motion drive a comparison of flange wear is also

*For an abstract of Mr. Wanamaker's paper, see the *Railway Mechanical Engineer* for March, 1919, page 160.

called for and for the removable brasses, mileage between shoppings and cost of upkeep for brasses are required.

Failures of Mechanical Stokers.—The Southern regional director calls the attention of federal managers to numerous delays and failures of locomotives equipped with mechanical stokers, due to iron bolts, and other metallic substances, as well as rock and other foreign material, left in bottoms of coal cars. Instructions should be issued through purchasing department and fuel inspection forces to insure that empty cars shall be thoroughly cleaned before loading, and every effort must be made to prevent any metal substance being loaded with coal. Supervisors and foremen in charge of coaling stations must be instructed that special effort be made to eliminate foreign matter, destructive to stoker equipment, when coal is loaded on locomotives. The Eastern regional director, by file 500-1-54A585 issues similar orders, and Order 170, Southwestern region, covers the same subject.

Locomotive Dictionary and Master Car Builders' Dictionary.—A. H. Smith, regional director. Eastern region by file 500-88A583, advises that the director general has authorized a continuance by the railroads of past practice with respect to the furnishing of the Locomotive Dictionary and the Master Car Builders' Dictionary to their mechanical and purchasing officers. The Southern regional director, file 1701-2-6, issues the same notice.

Journal Box Packing.—The regional director of the Eastern region, by circular No. 500-13-14A540, advises federal managers that journal box packing for locomotives and cars may be bought under the individual roads' specification, the Railroad Administration specification R-94-A not being compulsory.

Freight cars; Cost Limit of Repairs.—Supplement 1 to Circular 23 of the Northwestern regional director, in complying with paragraph 8 of Division of Operation Circular 20, includes a model for the report of inspection and estimated cost of repairs to freight cars recommended for retirement or application of betterments and states that after cars are inspected and reported on this form the federal manager of the using road will transmit the original and two copies, with his recommendation, to the federal manager of the owning road, who will transmit one copy to the corporation, securing its approval; retain one copy and return the original to the federal manager of the using road, notifying him of the action taken.

Sheds for Protection of Car Repairers.—The regional director, Eastern region, by Circular No. 1800-133A567 calls for information concerning laws requiring the construction of sheds for this purpose. The director general has been asked by the brotherhood to adopt a policy and is anxious to pass upon the matter with as little delay as possible. Federal directors are asked to advise what States now have car shed laws, and their provisions; what railroads have adopted the policy generally of providing car sheds at the more important car repair points, and to recommend what the practice should be.

Sleeping Cars for Japanese Railways.—The Imperial Government Railways of Japan have designed a type of sleeping cars for third-class passengers which, according to the Railway Times of Tokyo, is an ordinary day coach, the seats of which are convertible into lower berths while the upper berths are attachable at night. On the upper beds, which are located along the direction of the car, passengers can sleep in the usual Japanese manner, and on the lower, which are located crosswise, they can lie on their sides and can stretch their feet. The fare will be about 1 yen (50 cents) per day, including the extra fare for the high-speed train, and it is hoped that fairly good rest may be enjoyed by third-class passengers, which is the most important class in local passenger traffic.

FUSE SIZES FOR SHOP MOTORS

The proper size of fuse for a motor is only too often obtained by haphazard methods. The motor's normal operating current is given by the maker on the name-plate, but fuses are properly selected of a larger capacity to allow for starting and for momentary overloads. Hence it is rather more unusual for the maintenance man to select his fuses "be guess and be gosh," with a view to their permanence in service rather than the safety of the motor they are supposed to protect.

In order to give a practical working idea of what sizes to use, the Westinghouse Electric & Manufacturing Company has prepared the accompanying tables. These are based on the following assumptions as to size of fuse required to stand starting current without blowing:

Type	Times fuse load current at starting
Polyphase wound rotor	1¼
Squirrel cage (thrown on line)	3
Single-phase repulsion induction with rheostat	2
Single-phase repulsion induction without rheostat	4
Direct current	1¼

Since the fuses for squirrel-cage and repulsion motors without rheostats are, respectively, rated 3 and 4 times full-load current, they give practically no overload protection. Hence it is recommended that double-throw switches be installed connecting the motor through fuses of 1.25 times full-load rating (as under wound rotor sizes) for running and through the regular heavier fuses or direct to the line for starting.

Direct Current Motors

Horse power	Fuse rating in amperes with different voltages: 115 volts	230 volts	550 volts
1	10	5	3
1½	15	8	3
2	20	10	5
2½	25	12	6
3	30	15	6
3½	35	15	6
5	50	25	10
6½	65	35	15
7½	70	35	15
8½	85	45	20
10	90	45	20
11	100	55	25
12½	110	60	25
15	125	70	30
20	175	90	35
25	225	110	45
30	275	125	55
35	325	150	65
40	350	175	75
50	450	225	95
60	550	..	110
75	..	..	150
100	..	..	200

Three-Phase Wound Rotor Induction Motors

Horse power	Fuse rating in amperes with different voltages: 220 volts	440 volts	550 volts
5	20	10	8
7½	30	15	12
10	40	20	15
15	50	25	20
20	70	35	30
25	85	40	35
30	100	50	40
35	125	60	50
40	150	70	60
50	175	80	65

Two-Phase Wound Rotor Induction Motors

Horse power	Fuse rating in amperes with different voltages: 220 volts	440 volts
5	20	8
7½	25	15
10	35	20
15	45	25
20	60	30
25	70	35
30	90	45
35	110	55
40	120	60
50	150	70

Three-Phase Squirrel Cage Motors

Horse power	Fuse rating in amperes with different voltages: 110 volts	220 volts	440 volts	550 volts
½	12	6	3	2
1	20	10	5	4
2	35	20	10	8
3	50	30	15	12
5	90	45	25	20

Two-Phase Squirrel Cage Motors

Horse power	Fuse rating in amperes with different voltages: 110 volts	220 volts	440 volts
½	10	6	3
1	20	10	5
2	35	15	10
3	45	25	15
5	80	40	20

Type AR Single Phase Motors

Horse power	Fuse rating in amperes with different voltages: Without rheostat, 110 volts	Without rheostat, 220 volts	With rheostat, 110 volts	With rheostat, 220 volts
2	80	40	40	20
3	120	60	60	30
5	200	100	100	55
7½	325	175	175	80
10	400	200	200	100
½	20	10	10	6
¾	30	15	15	8
1	40	20	20	10

THE RESISTANCE OF MATERIALS

The Effect of Sudden or Abrupt Changes In Section on the Distribution of the Unit Stresses

BY G. S. CHILES and R. G. KELLEY

II.

IN the common theory of beams we assume that the elongation or shortening per unit of length of any fibre is proportional to the distance of the fibre from the neutral axis of the cross-section, that is, that the stress distribution or intensity is linear.

Professor Croker found by experiment* (optical method) the distribution of stress in rectangular beams with holes cut through them. In the upper specimen of Fig. 7 the two-inch diameter hole is located at the center on the neutral axis,

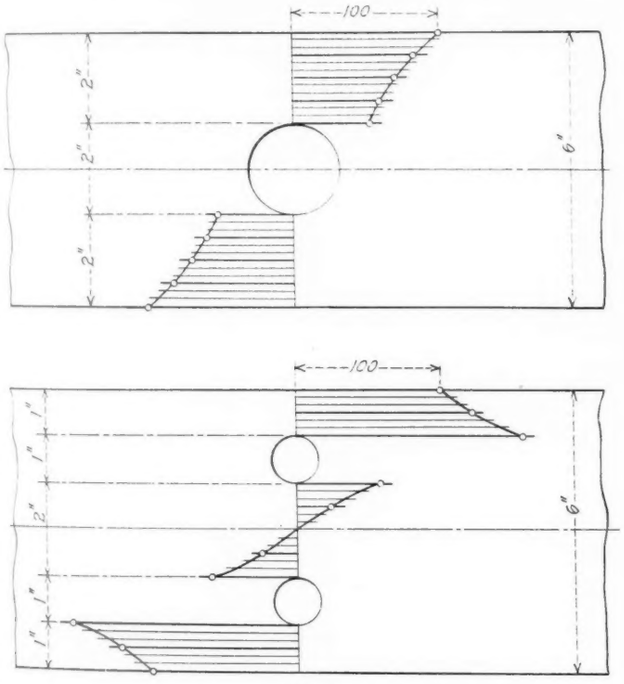


Fig. 7

while in the lower specimen two one-inch holes were placed half-way between the upper and lower edges and the longitudinal center line.

The maximum stress in the beam having the central hole occurs at the outer edge of the beam but the stress intensity is not directly proportional to the distance from the neutral axis. At the outer edge of the hole, which is one-third the distance to the outer edge of the plate, the stress intensity if linear should equal one-third the value for the outer edge. Instead it is some 52 per cent of the value of the intensity at the outer edge, or some 57 per cent more than if it were linear.

The maximum stress in the beam having the two one-inch holes does not occur at the outer edge of the beam but at the outer edge of each hole. The intensity of the stress at the outer edge of the holes is 132 per cent more than it would be if directly proportional to the distance from the neutral axis and is some 55 per cent more than the stress at the outer edge of the beam. The stress at the inner edge of the holes is 74 per cent more than it would be if directly proportional to the distance out. The stress intensity at the outer edge was used in obtaining the proportional stress intensity in all cases.

It is evident that holes, especially those located near the outer edges of a beam, have a decided influence on the intensity of stress.

For additional information on the effect of holes in beams the reader is referred to a paper, "Some Important Points in the Design of a Box Bolster," delivered before the St. Louis Railway Club at the May, 1918, meeting, by Professor Louis E. Endsley, of the University of Pittsburgh.*

RESULTS FROM VIBRATORY TESTS AND ACTUAL SERVICE

For the purpose of determining the effect of abrupt changes of section in a few of the forms which are commonly used in machine design when subjected to the action of alternating stresses, Professor T. E. Stanton carried out a series of experiments† on the four forms whose contour and dimensions are illustrated in Fig. 8. The form *a* is that which offers the maximum resistance to the load and the values of its resistances will be considered to represent the maximum resistance of the material. The form *b* is a test piece of similar contour but having its center section threaded; the form *c* represents a piece having a moderately rapid change of section brought about by the use of fillets,

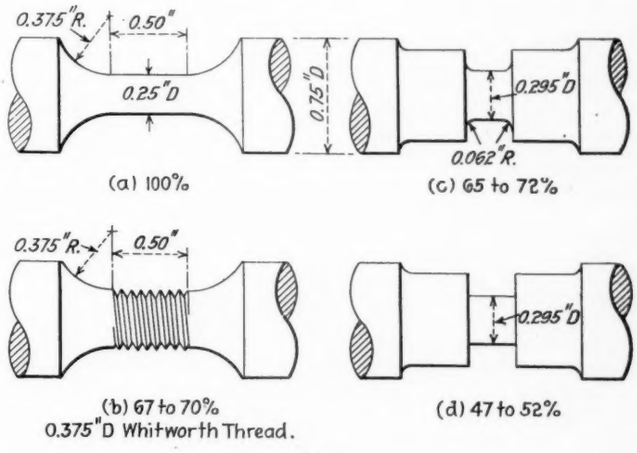


Fig. 8

while test piece *d* illustrates a form in which the change of section at the junction of the center section and shanks is abrupt due to the absence of fillets.

The results of Professor Stanton's tests upon these four forms and four carbon percentages for each form are set forth graphically in the diagram, Fig. 9, the carbon content of the various test pieces being plotted as abscissae and the limiting range of stresses being plotted as ordinates. The curve *a* is the resistance curve of the section of maximum resistance designated by the corresponding letter in Fig. 8.

*See Engineering (London), March 3, 1912.

*See *Railway Mechanical Engineer* for June, 1918, page 343.

†See "A Factor in the Design of Machine Details," by T. E. Stanton, D. Sc., M. Inst. C. E., Engineering (London), April 19, 1907.

The curve *b* is the resistance curve of the threaded test specimen. It is evident that the resistance of a section which has been threaded has been reduced to a value ranging from 67 per cent to 70 per cent of the maximum resistance of the material.

Professor Stanton discusses the resistances of the screw threads as follows:

"The above resistances are, of course, estimated per unit of area, so that in calculating the strength of a screwed rod under alternating stress it will be further necessary to take into account the area at the bottom of the threads, so that the total reduction in resistance may well be more than 50 per cent of its maximum value.

"In the case of screw threads there is a further possible source of weakness due to faulty machining in the cutting of the screw. If the bottoms of the threads are not properly curved, (see Fig. 10 for enlarged section), but left with a sharp angle, there can be no doubt that risks of the development of a crack are very considerably increased. It seems quite probable that failures of steam-engine cross-head bolts, which have broken under very low range of stress, may be due to this cause. . . ."

The diameter at the root of the thread for the 3/8-in. screw

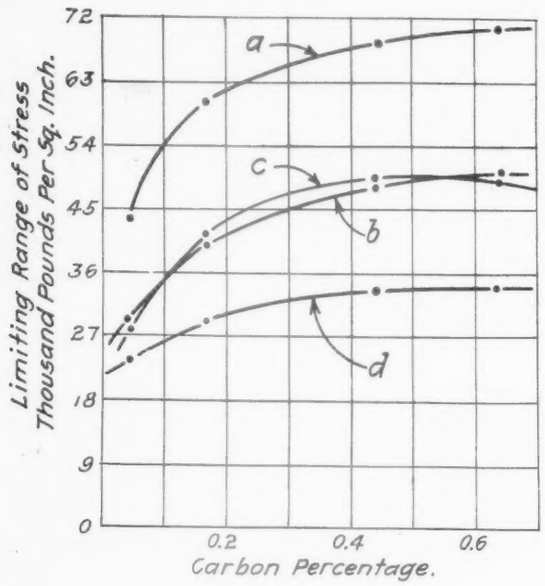


Fig. 9

is 0.2950 in. He obtained practically the same results for the resistance of the specimen having a gradual change of section when subjected to alternating stresses, as shown by the curve *c* which is the resistance curve of the section marked *c* in Fig 8. This curve indicates that the resistance of the section varies from 65 per cent to 72 per cent of the maximum resistance of the material as plotted in curve *a*. Finally, the resistance of section *d* was found to be from 47 per cent to 52 per cent of section *a*, Fig. 8. In regard to this curve, Professor Stanton directs especial attention to the fact that, while the maximum resistance of the test specimens of this form does not increase as the carbon content is increased in as great proportion as in the case of curves *a*, *b* and *c*, the resistance of the 0.4 and 0.6 carbon steels is about 40 per cent greater than that of the iron.

It is evident, therefore, that stress distribution is affected by any sudden change of section and the assumptions that the stress due to an axial load is uniformly distributed, or that a member subjected to bending has a linear distribution of stress from the neutral axis outward are not justified. For members not subjected to repeated or alternating stresses this would appear not to be especially serious. But in the case of members subject to dynamic action, the available information seems to indicate that extreme caution is necessary in members having abrupt sections, since any sudden change of section very greatly reduces the endurance of members subjected to a repetition of loading. Aside from service stress considerations the designer must give thought to the

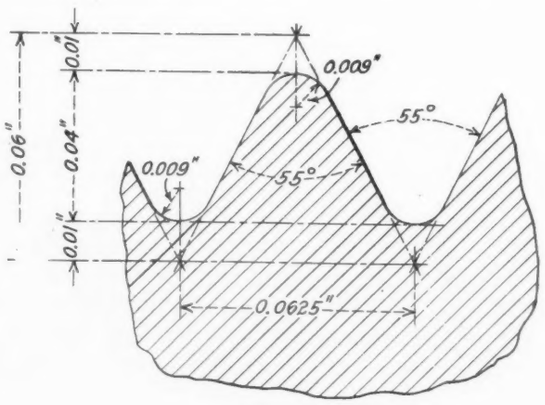


Fig. 10

manufacturing side, especially so in the case of heat treated parts.

EXPERIMENTS WITH RUBBER TEST SPECIMENS

In casting about, some time ago, for a suitable means to illustrate in a general way the results which might be expected from the effect of sudden or abrupt changes of section upon the distribution of stress the idea was hit upon to use models made of rubber. It was thought this would visualize

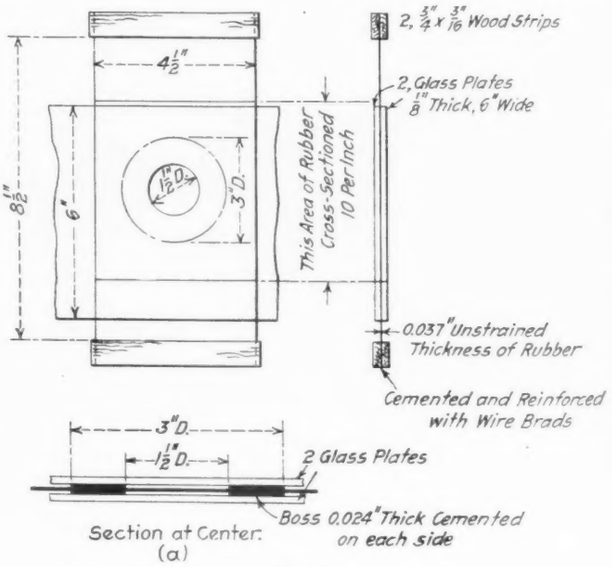


Fig. 11

the act on and thus bring it more forcibly to the reader's attention.

The question may be raised as to whether or not there is any justification for comparing the action, under strain, of rubber with that of other materials more commonly used in engineering practice. In a recent investigation* for the purpose of determining Young's Modulus, which is the ratio of unit stress to unit strain or deformation, and Poisson's

*The Analysis of Finite Extensions and Elasticity of Rubber, Annalen der Physic, No. 21, 602, Nov., 1906.

Ratio, which is the ratio of lateral strain to longitudinal strain, (in the case of extension, the ratio of the elongation per unit of length to the contraction per unit of lateral dimension), O. Frank found it convenient to employ models consisting of a high grade of Para rubber. In this instance Mr. Frank used a test piece which was in the form of a strip 15.75 in. long, 3.94 in. wide and 0.016 in. thick and had fine lines about 3.15 in. apart ruled across it near its center when in a normal or unstrained condition. By measuring the distance between these ruled lines for each new extension of the strip up to a maximum extension of something less than 200 per cent, he obtained as the mean value of Poisson's ratio for rubber 0.46. Landolt and Börnstein (Physikalisch Tabellen) give, as the value of Poisson's ratio for rubber, 0.49.

For concrete, Poisson's ratio is from 0.1 to 0.13 and for the metals in general it ranges from 0.2 to 0.38, being from 0.25 to 0.33 for steel. As a preliminary to the experimental investigations which follow, tests were conducted upon a strip of rubber 1½ in. wide, ¼ in. thick and 14 in. long in order to determine the value of Poisson's ratio for the material. This was found to be approximately 0.33.

The rubber from which the models employed in the experiments covered by Figs. 12 to 15 inclusive were made was a high grade dental gum while that used for the experiments illustrated by Figs. 16 to 20 inclusive was a grade of ¼ in. rubber manufactured especially for the purpose.

A series of experiments was first conducted upon a number of rubber strips 4½ in. in width which were perforated with holes located as shown at *a*, *b* and *c* in Fig. 1. The diameter of the circular hole in the center of the strip indicated at *a* was 1½ in.; the diameter of each of the semicircular holes located on the outer edges at the midlength of the strip marked *b* was also 1½ in., while the square hole located at the center of the strip designated by *c* was 1½ in. square. The ends of the rubber bands were attached to small wooden strips (see Fig. 11) and while in an unstrained condition the rubber was ruled for a length of 5 inches with equally spaced horizontal and vertical lines of white show card ink, 10 lines to the inch, as shown in Fig. 12*a*. The dark ink lines which appear on the tracing cloth underneath the rubber, are for the purpose of comparison.

Fig. 12*b* shows the rubber strip when subjected to a pull of five pounds. In order to overcome the tendency of the rubber to buckle when in this condition, as is noticeable in the photograph, a glass plate was pressed lightly against either side of the rubber band as indicated in Fig. 12*c*, care being taken to apply to the plates an amount of pressure sufficient only to eliminate the tendency to buckle. The pressure was applied to the glass plates gradually while the pull was being applied thus allowing the rubber band freedom of movement and at the same time retarding the tendency toward buckling.

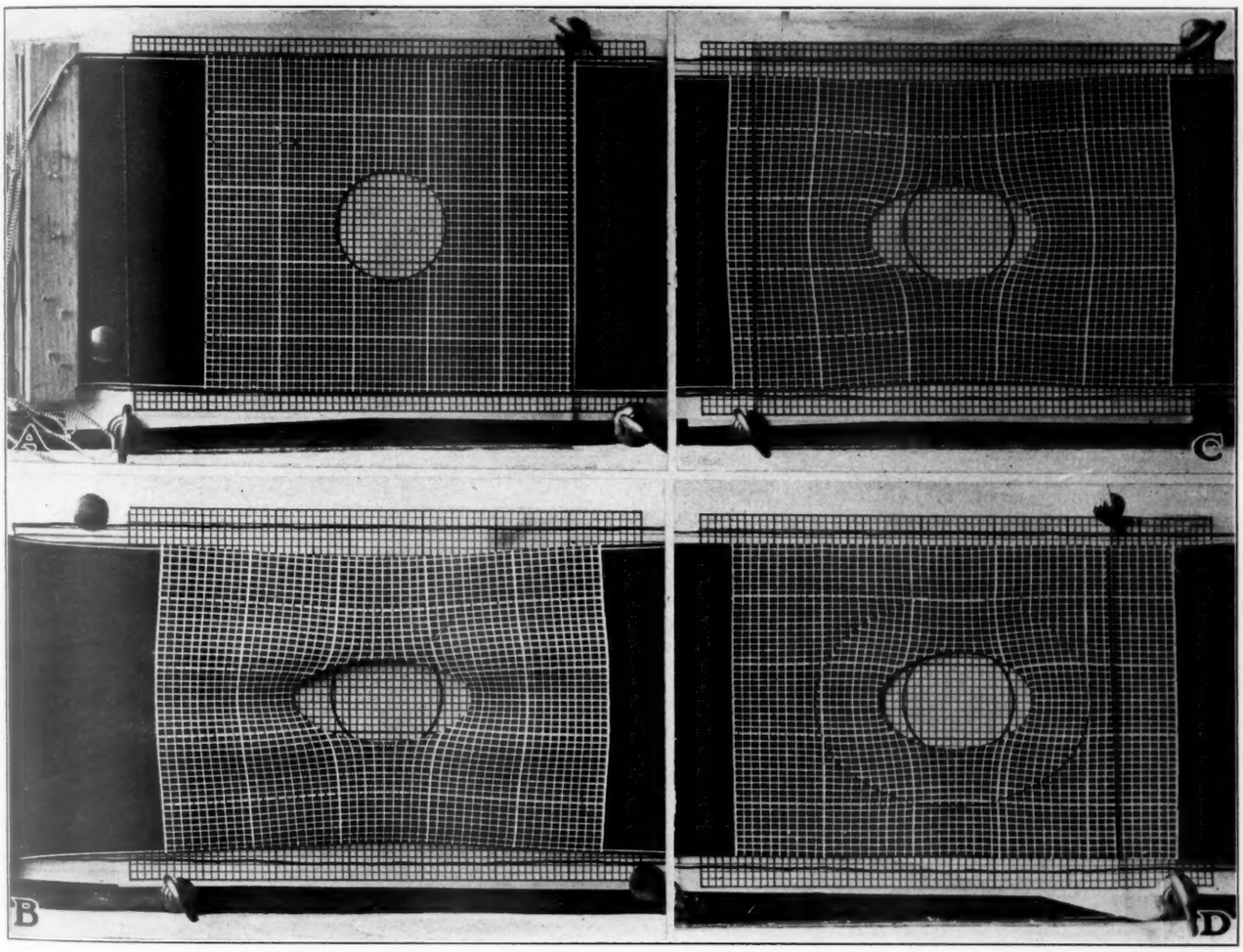


Fig. 12—The Effect of a Central Hole with and without Bosses, on the Stress Distribution in Sheet Rubber Under Tension

In Fig. 12*a* a part of the heavy black ink lines outlining the edge of the hole and the outer edge of the rubber strip are shown. In Fig. 12*b*, the hole in the rubber has decreased

0.4 in. in width while the total width of the strip is about 0.7 in. less. After the glass pressure plates were applied the width of the hole decreased only about 0.2 while the total width of the strip was 0.5 in. less than in the unstrained condition. Thus the net width of the rubber through the center of the hole when given a five-pound pull was about 0.3 in. less when the glass plates were applied than it was in the unstrained condition.

That the rubber is strained relatively more near the inner edge of the hole is evident from the distance between the ruled white lines, at the side of the hole. At the ends of the hole the strained length is really less than the unstrained length, showing the rubber to be in compression at these points. The vertical and horizontal lines clearly visualize the action found and measured by the polarized light method as plotted in Fig. 3.

In discussing the stresses shown in Fig. 3, reference was

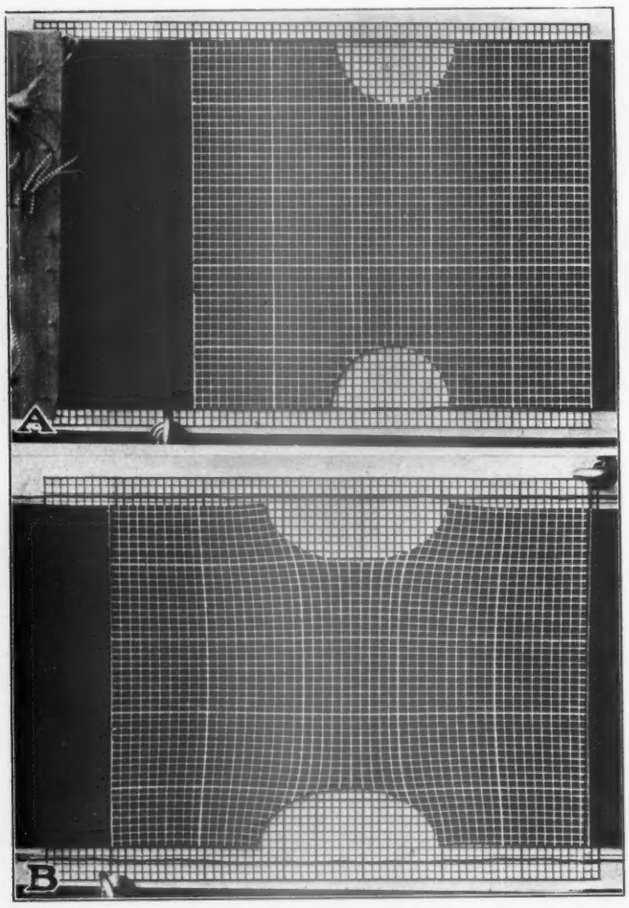


Fig. 13—Effect of Semi-circular Notches in Sides of Sheet Rubber Specimen Under Tension

made to the longitudinal stress f_t in the same direction as the pull and the radial stress f_{tr} of the stress at right angles to longitudinal stress. These stresses as well as those referred to in connection with Figs. 4, 5 and 6 are clearly illustrated by the action of the white ink lines on the rubber strips and by the eye bar of Fig. 16*b*.

The pictures of the rubber models in all the experiments showing the unstrained position were taken after the maximum strain position, the idea being to demonstrate that the models had not been given a permanent set, in other words, that the action was entirely elastic. The photograph shown in Fig. 12*a* was not taken until after the photographs of Fig. 12*b* and *c* had been taken.

Fig. 12*d* illustrates the strained condition of a strip of rubber subjected to a pull of five pounds which is alike in all respects to the strip of rubber shown in Fig. 11 except that a boss 0.024 in. thick was cemented on either side around the hole before the lines were ruled in. The location, size, etc., of the bosses are indicated by dotted lines in Fig. 11. The total cross-sectional area of the material immediately adjacent to the hole is now greater than that of the remaining portions, the total thickness of the bosses being 0.048 in. while the thickness of the rubber strip itself is 0.037 in. In this instance, the glass plates came in contact with the bosses only as indicated at *a* in Fig. 11. It is evident that the effect of the addition of the bosses has been to reduce the intensity of the stress, although the action is similar to that when no bosses were applied, the maximum stress near the edge of the hole is still greater than the average stress over the central section.

Fig. 13*a* represents a strip of rubber similar to that of Fig. 12 except that it is provided with semi-circular holes, each of which is equal in area to half of the hole in the original strip, located at either side of the strip on the same center line as shown at *b* in Fig. 1. The strip is shown in an unstrained position, ruled up in a similar manner, in contact (without pressure) with glass plates above and beneath, and resting, as in the preceding case, upon a strip of tracing cloth ruled with heavy black ink reference lines.

Fig. 13*b* illustrates the distribution of stress in this rubber strip, when subjected to a pull of five pounds and with the pressure plates in action as in the preceding cases. The resulting lines of distortion are very similar to the case illustrated in Fig. 12*c* where the hole was central.

(To be concluded)

One of the Engines Recently Surrendered to the French and Its Crew

THE ATLANTIC CITY CONVENTIONS

Government and Program of June Meeting of Mechanical Section, American Railroad Association

THE American Railway Association has been reorganized as the American Railroad Association with five sections covering operating, engineering, mechanical, traffic and transportation. The mechanical section consists of the former American Railway Master Mechanics' Association and the Master Car Builders' Association, the work of which is now combined and co-ordinated with that of the similar organizations in other departments, through the parent organization.

Circular S-3, No. 1a has been issued by the American Railroad Association giving the personnel of the general committee which will be in charge of the convention at Atlantic City next June, together with the rules of order and a list of the committees which will report at the convention.

The general committee is made up as follows:

C. E. Chambers, mechanical assistant, Allegheny Region, chairman.
W. J. Tollerton, general mechanical superintedent, Rock Island Lines, vice-chairman.
Frank McManamy, assistant director, Division of Operation, U. S. R. A.
C. B. Young, manager, Inspection Test Section, Division of Operation, U. S. R. A.
F. F. Gaines, chairman, Board of Railway Wages and Working Conditions.
I. S. Downing, general master car builder, C. C. C. & St. L.
J. S. Lentz, master car builder, Lehigh Valley.
M. K. Barnum, assistant to general superintendent, maintenance of equipment, Baltimore & Ohio.
J. R. Gould, superintendent motive power, Chesapeake & Ohio.
A. Kearney, superintendent motive power, Norfolk & Western.
C. E. Fuller, superintendent motive power and machinery, Union Pacific.
T. H. Goodnow, superintendent car department, Chicago & North Western.
J. W. Small, mechanical assistant, Southern Region.
C. F. Giles, superintendent machinery, Louisville & Nashville.
J. E. O'Brien, mechanical superintendent, Missouri Pacific.
A. P. Prendergast, mechanical superintendent, International & Great Northern.
H. R. Warnock, general superintendent motive power, Chicago, Milwaukee & St. Paul.
James Coleman, superintendent car department, Grand Trunk.
W. H. Winterrowd, chief mechanical engineer, Canadian Pacific.

RULES OF ORDER

The following are the rules of order which will govern the conduct of the section:

1. (a) The membership of Section 3—Mechanical—shall consist of three classes: representative, affiliated and life.

(b) Representative members shall be those officials of railroads above the rank of general foreman having charge of the design, construction or repair of motive power or rolling stock, who shall be designated by the federal manager or executive official of the member of the association to serve in the section.

(c) Any person having such knowledge of science or practical experience in matters pertaining to the construction of motive power or rolling stock as would be of special value to the section may become an affiliated member on being recommended by three representative members. The name of such candidate shall then be referred to the general committee which shall report to the section on his fitness for such membership. He shall be elected by written or printed ballot at any regular meeting of the section held not less than six months after the candidate has been proposed and five dissenting votes shall reject. Affiliated members shall be entitled to all the privileges of representative members excepting that of voting and being elected to office in the section and may serve on committees on appointment by the general committee, in addition to the regularly elected members of such committee.

Such membership shall continue until written resignation is received by the secretary or the membership is terminated by the general committee or by the members becoming engaged in business which, in the judgment of the general committee would impair his usefulness to the section or discriminate against others, similarly engaged. Affiliated members shall not be subject to dues or assessments.

(d) Representative members who have been in good standing twenty years, or members who have served as chairman of the section may become candidates for life membership on the recommendation of the general committee. The names of such members shall be referred to the section in convention for election by written or printed ballot at any regular meeting of the section and five dissenting votes shall reject.

(e) Those persons, active or representative members, who have been in good standing in either the Master Car Builders' Association or the American Railway Master Mechanics' Association for twenty years, or members who have served as president of either association or as chairman of the section may also become candidates for life membership. Those now carried by the Master Car Builders' Association as life members or by the American Railway Master Mechanics' Association as honorary members will be continued as life members of Section Three—Mechanical.

2. (a) In addition to the chairman, vice-chairman and the general committee of the section, a nominating committee shall be elected.

(b) The general committee shall consist of sixteen elected members, including the chairman and the vice-chairman of the section, and, in addition, during the period of federal control, of three representatives of the United States Railroad Administration to be designated by the director of the Division of Operation. The elected members during federal control shall consist of two representatives from each region and two representing the Canadian railroads.

3. The duties of all officers shall be such as shall pertain to their offices or as may be delegated to them by the general committee of the section.

4. (a) The general committee shall exercise general supervision over the interests and affairs of the section, call, prepare for and conduct general conventions.

(b) The general committee shall exercise such supervision over the standards, recommended practice, or rules of this section as may be necessary to meet any emergency that may arise during the year in the conduct of the affairs of the section.

(c) It shall make a report at each convention which shall cover the action it has taken on such general or emergent supervision and make such recommendations as it may deem necessary on questions of importance to the section.

(d) The general committee shall select and appoint the members of the several standing committees and of such special committees as may be found necessary from time to time for conducting the business of the section and for investigating such matters as may be referred to the section or the committee may deem expedient to carry out the purpose of the section. It shall make appointments to the membership of any of the committees that may be necessary to fill any vacancies which may occur.

(e) The general committee shall receive, examine and approve before public reading all communications, papers and reports and it shall decide what portion of the reports, papers and drawings shall be submitted to each convention and what portion shall be printed in the annual report. It shall also determine which, if any, of the subjects presented at the convention or by members shall be referred to the executive committee of the association.

(f) The general committee shall offer to the convention the names of ten representative members not officers of the section as candidates for the committee on nominations.

(g) The general committee may call special meetings of the section to be held not less than thirty days after the notice thereof has been mailed to each member of the section.

(h) Nine members of the general committee shall constitute a quorum for the transaction of business.

5. (a) It shall be the duty of the committee on nominations to offer to the convention the name of one representative member as a candidate for chairman and one for vice-chairman, and the names of seven representative members as candidates for the general committee.

(b) When twenty or more members desire to propose the name of a member for any office, in addition to the names suggested by the committee on nominations, the secretary shall place the name or names of such persons for said office on the printed ballot, making a statement to the effect that such name or names has been proposed by a certain number of members.

6. (a) It shall be the duty of the secretary to issue a circular annually, intimating the date and place when and where candidates may be examined for the scholarships of the section.

(b) Acceptable candidates for the scholarship shall be first, sons of members or of deceased members of the section.

If there is not a sufficient number of such applicants for the June examination, then applications will be received from other railroad employees or the sons of other railroad employees for the fall examination. The secretary shall issue a proper circular in this case as before. In extending the privilege outside of the families of members, preference shall be given to employees or the sons of employees or the sons of deceased employees of the mechanical departments.

(c) Candidates for these scholarships shall apply to the secretary of this section and if found eligible shall be given a certificate to that effect for presentation to the school authorities. This will entitle the candidate to attend the preliminary examination. If more than one candidate passes the preliminary examination, the applicant passing the highest examination shall be entitled to the scholarship, the school authorities settling the question.

(d) The successful candidate shall be required to take a course prescribed by the general committee.

7. (a) The officers, excepting as otherwise herein provided, shall be elected at the regular meeting of the section held in June of each year and the election shall not be postponed except by unanimous consent.

(b) The chairman and the vice-chairman of the section shall be elected by written or printed ballots alternately every second year, the candidate receiving a majority of the votes cast shall be declared elected and shall hold office for two years or until his successor shall be elected.

(c) Members of the general committee and the committee on nominations shall be elected by written or printed ballots. Seven members of the general committee will be elected at each regular session to serve for

two years. Five members of the committee on nominations will be elected annually.

(d) In the election of members of the general committee and the committee on nominations each representative member is entitled to one vote.

8. (a) At the first session of the annual meeting the report of the committee on nominations announcing the names of the nominees for officers and the general committee of the section shall be read. Elections shall not be held before the day after such announcement except by unanimous consent. Votes may be cast for any member eligible to serve as chairman, vice-chairman, members of general committee or members of committee on nominations by adding the name to the printed ballot.

(b) In all ballots for chairman, vice-chairman, members of general committee and committee on nominations or for affiliated or life members at the meetings of the section, the following form of voting shall be adhered to: An envelope shall be provided on which there shall be a blank space for the name of the railroad, and the name of the official voting; smaller envelopes shall be provided on which shall be printed the words "For Officers," "For Members General Committee," "For Members Committee on Nominations," "For Affiliated and Life Membership," and otherwise unmarked. In these envelopes the ballots shall be placed by those voting them and they shall then be placed within the larger envelope and presented to the general tellers. When a ballot is to be taken the chairman will announce the names of all required tellers. Three general tellers shall have charge of receiving and recording the ballots cast. When all ballots have been cast these tellers will announce that the polls are closed. They shall then remove the smaller envelopes, count and announce the vote for officers and shall deliver the envelopes marked "For General Committee" to two tellers, who shall count and announce to the general tellers the vote for general committee and those marked "For Committee on Nominations" to two tellers who shall count and announce to the general tellers the vote for the committee on nominations, and those marked "For Affiliated and Life Members" to two tellers who shall count and announce to the general tellers the vote for affiliated and life membership.

(c) The general tellers shall record and announce the total number of votes cast, the result of the vote, and shall be the judges of eligibility of any ballot presented.

(d) When a ballot for officers or membership on committees shall be announced as having eventuated in a tie vote, or be otherwise undecided, upon such announcement the final result shall be determined by the majority of the members present.

9. (a) Unless otherwise provided herein, a vote in the session of the section may be taken *viva voce*, by arising, or by written or printed ballot in any of which only representative members and representatives of the United States Railroad Administration shall participate. Letter ballots may be ordered to be taken in such manner and under such conditions as the section may by resolution from time to time or the general committee may direct.

(b) Printed ballots for use in the election of officers, members of the general committee and the committee on nominations, and for affiliated and life memberships to be of the form as prepared by the committee on nominations.

10. (a) At each annual meeting, the chairman shall appoint a committee on subjects whose duty it shall be to report at the next annual meeting subjects for investigation and discussion, and if the subjects are approved by the section, the general committee as hereinafter provided, shall appoint committees to report on them. It shall also be the duty of the committee on subjects to receive from members questions for discussion during the time set apart for that purpose. That commitee shall determine whether such questions are suitable ones for discussion, and if so, it shall report them to the section.

(b) When the committee on subjects has reported and the section approved of subjects for investigation, the general committee shall appoint individuals or special committees to investigate and report on any subject which a majority of the members present may approve; or individual papers may be presented to the section after approval by the general committee. Papers and reports shall be presented by abstracts, which shall not occupy more than ten minutes in the reading unless otherwise ordered by the section.

(c) Any proposition recommending the adoption of standard construction or practice shall be in writing and be accompanied by drawings, if the latter are necessary for a clear understanding of the subject. Such proposition shall then be submitted to the section for discussion, after which a vote shall be taken to decide whether the proposition shall be submitted for decision by letter ballot to all the members entitled to vote. If decided in the affirmative, the secretary within two months from the time the vote of the section is taken on such measure, shall send by mail to each member a blank ballot, and a copy of the proposed recommendation, with a report, to be approved by the general committee of the discussion thereon; such ballot to be returned to the secretary, who will count all the ballots received within thirty days from the date they were sent to the members, and he shall then announce the vote in such manner as the general committee may prescribe. Any recommendation securing two-thirds of the votes cast shall be adopted by the section.

(d) All reports, resolutions and recommendations involving the use, or proposed use, by railroads, of any device or process which forms the subject matter of any existing patent, shall first be submitted to the general committee, and shall be submitted to the section only by the general committee.

11. (a) The regular annual meeting of the section shall be held in June of each year. The dates of such meeting shall be fixed by the general committee.

(b) The regular hours of session shall be arranged by the general committee and published on the program for each meeting.

(c) The place for each annual meeting shall be fixed at least four months before the annual meeting by the general committee.

(d) At any regular meeting thirty or more members entitled to a vote shall constitute a quorum.

(e) The business of the meetings of the section shall, unless otherwise ordered by a vote, proceed in the following manner:

1. Address by the chairman.
2. Acting on the minutes of the last meeting.
3. Report of secretary.
4. Appointment of resolutions and other committees.
5. Unfinished business.
6. New business.
7. Reports of committees.
8. Reading and discussing questions propounded by members.
9. Routine and miscellaneous business.
10. Election of officers.
11. Adjournment.

12. The revision of the rules of interchange shall be the special order of business at 10:00 a. m. on the second day of each annual convention, unless otherwise ordered.

13. Unless otherwise ordered, the discussion of questions proposed by members shall be the special order at 12:00 noon of each day of the annual meeting.

14. The votes of a majority of the members present shall be required to decide any question, motion or resolution which shall come before the section, unless otherwise ordered. Matters upon which authoritative action is required after approval by the section shall be submitted to the executive committee of the association, through the general secretary.

15. (a) The reports of all committees must be in the office of the secretary not later than April 1 in order that the same can be printed and advance copies issued 30 days prior to the opening date of the convention.

(b) Committee reports which do not reach the secretary as provided for in paragraph (a) will be referred to the general committee to decide whether the report shall be submitted to the convention.

(c) An abstract of the report of each committee will be read to the convention, together with whatever additional data may have been accumulated after the publication of the reports.

(d) The members of committees who may individually or collectively submit a minority report must prepare the same so that it can be issued with the report of the majority to substitute for the majority report in the event the section shall so decide.

(e) Each member of a committee must approve either the majority or a minority report.

16. These rules of order may be amended at any regular meeting by a two-thirds vote of the members present provided that written notice of the proposed amendment has been given by the general committee at least four months before.

REPORTS OF COMMITTEES

Thirty-one committees will report at the convention. The first 20, ordinarily considered as Master Car Builders' committees, will report from June 18 to June 20, and 11 committees which would be considered strictly as committees of the Master Mechanics' Association will report from the period of June 23 to June 25. The election of officers will take place on Saturday, June 21. The list of committees is as follows:

June 18-20, 1919, Inclusive.

1. Arbitration, J. J. Hennessey (C. M. & St. P.), chairman.
2. Standards and Recommended Practice (M. C. B.), T. H. Goodnow (C. & N. W.), chairman.
3. Train Brake and Signal Equipment, T. L. Burton (N. Y. C.), chairman.
4. Brake Shoes and Brake Beam Equipment, B. B. Milner (N. Y. C.), chairman.
5. Couplers, R. L. Kleine (Pennsylvania), chairman.
6. Loading Rules, J. J. Burch (N. & W.), chairman.
7. Car Wheels, W. C. A. Henry (Pennsylvania Lines West), chairman.
8. Safety Appliances, C. E. Chambers (U. S. R. A.), chairman.
9. Car Construction, W. F. Keisel (Pennsylvania), chairman.
10. Specifications and Tests for Materials (M. C. B.), F. M. Waring (Pennsylvania), chairman.
11. Car Trucks, J. T. Wallis (Pennsylvania), chairman.
12. Prices for Labor and Material, P. F. Smith, Jr. (Pennsylvania Lines West), chairman.
13. Train Lighting and Equipment, J. R. Sloan (Pennsylvania), chairman.
14. Nominations, F. W. Brazier (N. Y. C.), chairman.
15. Tank Cars, A. W. Gibbs (Pennsylvania), chairman.
16. Draft Gears, R. L. Kleine (Pennsylvania), chairman.
17. Welding Truck Side Frames, Bolsters and Arch Bars, W. O. Thompson (N. Y. C.), chairman.
18. Standard Blocking for Cradles of Car Dumping Machines, James McMullen (Erie), chairman.
19. Revision of Passenger Car Rules of Interchange, H. H. Harvey (C. B. & Q.), chairman.
20. Depreciation for Freight Cars, M. K. Barnum (B. & O.), chairman.

June 23-25, 1919, Inclusive.

21. Standards and Recommended Practice (A. R. M. M.), W. E. Dunham (C. & N. W.), chairman.
22. Mechanical Stokers, A. Kearney (N. & W.), chairman.
23. Fuel Economy and Smoke Prevention, William Schlafge (Erie), chairman.

24. Powdered Coal, C. H. Hogan (N. Y. C.), chairman.
25. Specifications and Tests for Materials (A. R. M. M.), F. M. Waring (Pennsylvania), chairman.
26. Design and Maintenance of Locomotive Boilers, C. E. Fuller (Union Pacific), chairman.
27. Locomotive Headlights, H. T. Bentley (C. & N. W.), chairman.
28. Superheater Locomotives, W. J. Tollerton (C. R. I. & P.), chairman.
29. Design, Maintenance and Operation of Electric Rolling Stock, C. H. Quereau (N. Y. C.), chairman.
30. Train Resistance and Tonnage Rating, O. P. Reese (Pennsylvania Lines West), chairman.
31. Subjects, M. K. Barnum (B. & O.), chairman.

STANDARD 2-8-8-2 TYPE LOCOMOTIVES

First of Government Order for Over 100 of These Engines Delivered to the Norfolk & Western

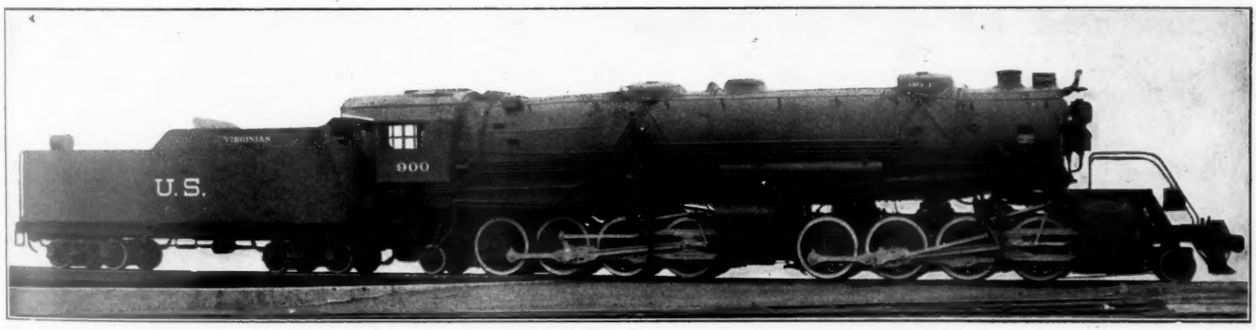
THE first order of 1,025 locomotives placed by the United States Railroad Administration included an order of 20 heavy (2-8-8-2) standard Mallets. This was later increased to over 100, 65 to be built by the American Locomotive Company and 41 by the Baldwin Locomotive Works. The American Locomotive Company has within the past month made the first delivery of these locomotives. While they were scheduled and lettered for the Virginian Railway they have been assigned for duty on the Norfolk & Western. These engines are the largest of the standard locomotives built for the Railroad Administration and represent the limit to which a locomotive can be built to come within the maximum clearance limitations set by the Railroad Administration (15 ft. 9 in. high and 10 ft. 9 in. over cylinders). These locomotives are smaller than those which can be used on the Virginian Railway, as evidenced by the 2-10-10-2 type Mallet locomotives which were recently built for that road by the American Locomotive Company. These latter engines have a width clearance of 12 ft. and a height clearance of 16 ft. 7½ in. On the other hand, the clearance limitations of these standard engines compare very favorably with the 2-8-8-2 Mallets recently built by the Norfolk & Western to that company's own design. Being limited by these clearance restrictions a very careful design had to be made to provide a locomotive of the power required.

In the matter of power these standard engines may be compared with locomotives of similar wheel arrangement built by the Norfolk & Western in its own shops, and for the Western Maryland by the Lima Locomotive Company. A table comparing the principal dimensions of these two locomotives is included. A description of the Norfolk & Western locomotive was published in the *Railway Mechanical Engineer* of August, 1918, page 445. From this table of comparison it will be seen that the standard locomotive is 6,000 lb. heavier than that built by the Norfolk & Western, and 3,300 lb. heavier than that built for the Western Maryland. The working pressure on the standard locomotive is also 10 lb. greater than that of the Norfolk & Western locomotive and 30 lb. higher than that used on the Western Maryland locomotive. The boiler proportions of the standard locomotive and those of the Norfolk & Western compare very favorably. However, the Norfolk & Western design provides about 200 sq. ft. more heating surface and about 35 sq. ft. greater superheating surface. While these two engines are very nearly alike in proportions, they are of an entirely different class as far as the construction details are concerned, which will necessitate a different line of repair parts and illustrates one of chief objections to standardization.

TABLE OF COMPARISON OF 2-8-8-2 TYPE LOCOMOTIVES

Name of road	U. S. Std.	Norfolk & Western	Western Maryland
When built	1919	1918	1915
Tractive effort, compound, lb.	106,000	104,300	106,000
Weight, total, lb.	531,000	535,000	495,000
Weight on drivers, lb.	57	56	52
Diameter of drivers, in.	478,000	472,000	445,000
Cylinders, diameter and stroke, in.	25 and 39 by 32	24½ and 38 by 32	26 and 40 by 30
Steam pressure, lb., per sq. in.	240	230	210
Total heating surface, sq. ft.	6,120	6,316	5,669
Superheater heating surface, sq. ft.	1,475	1,510	1,264
Grate area, sq. ft.	†96	96	80
Weight on drivers ÷ tractive effort (compound)	4.7	4.5	4.2
Tractive effort × diameter drivers ÷ equivalent heating surface*	695.	680.6	726.3
Equivalent heating surface* ÷ grate area	86.6	89.4	94.9

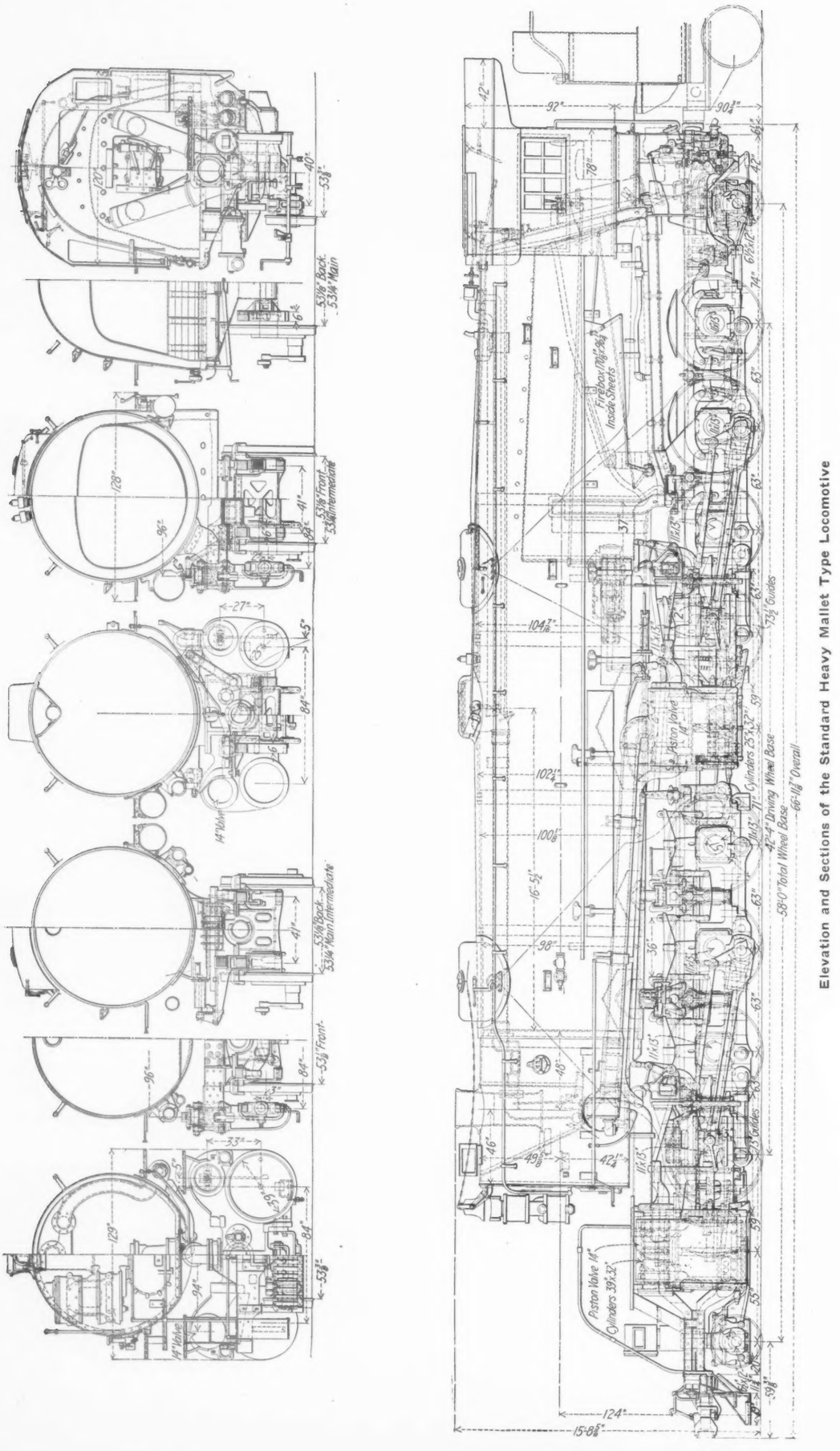
*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.
†Gaines combustion chamber is used on this locomotive.



Standard 2-8-8-2 Type Locomotive for the U. S. Railroad Administration

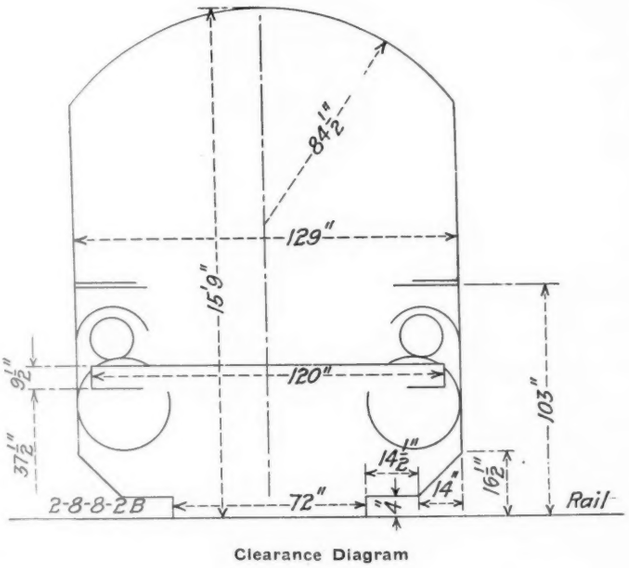
The standard 2-8-8-2 Mallet locomotive has a total engine weight of 531,000 lb., of which 28,000 lb. is on the leading truck, 237,000 lb. on the front or low pressure unit, 241,000 lb. on the high pressure unit and 25,000 lb. on the trailing truck. It is built for a permissible axle load of 60,000 lb., which is the same limit prescribed for the standard 2-6-6-2 locomotive. The cylinders are 25 in. and 39 in. by 32 in., and a working pressure of 240 lb. is carried on the boiler. The distribution of the weights amongst the various drivers is shown in the weight diagram, which was prepared by F. P. Pfahler, chief mechanical engineer of the Mechanical Department, United States Railroad Administration. The clearance diagram, also prepared by Mr. Pfahler, is included in the illustrations.

The boiler of these locomotives has an outside diameter



Elevation and Sections of the Standard Heavy Mallet Type Locomotive

at the first ring of 98 in. It is of the straight barrel type and has shell plates 1 1/16 in. thick. The dome is located on the third course and on account of the clearance limitation is only nine inches high. The boiler is equipped with a Gaines combustion chamber. The length of tubes is 24 ft. There are 274 2¼-in. tubes and 53 5½-in. flues, which are of No. 8 gage, being one gage heavier than the general standard practice in the construction of Mallet locomotives, due to the fact that a working pressure of 240 lb. is carried on the boiler. The firebox is 170⅛ in. by 96¼ in., having an effective grate area of 96.2 sq. ft. The firebox sheets are ⅜ in. thick and the back tube sheet is ½ in. thick. The tube



Clearance Diagram

spacing is similar to that used on the standard 2-6-6-2 type Mallets.

The frames for these locomotives are 6 in. in width, the same as for the 2-6-6-2 locomotives and are 6¾ in. deep over the pedestals, having a minimum thickness of 5½ in. The lower rails are 4½ in. deep, with a minimum thickness of 4 in. The frames for the high and low pressure engines are connected with the Baldwin type of frame hinged casting. From the standpoint of design they are, with the exception of differences in dimensions, practically exact duplicates of the frames built for the standard 2-6-6-2 locomotive.

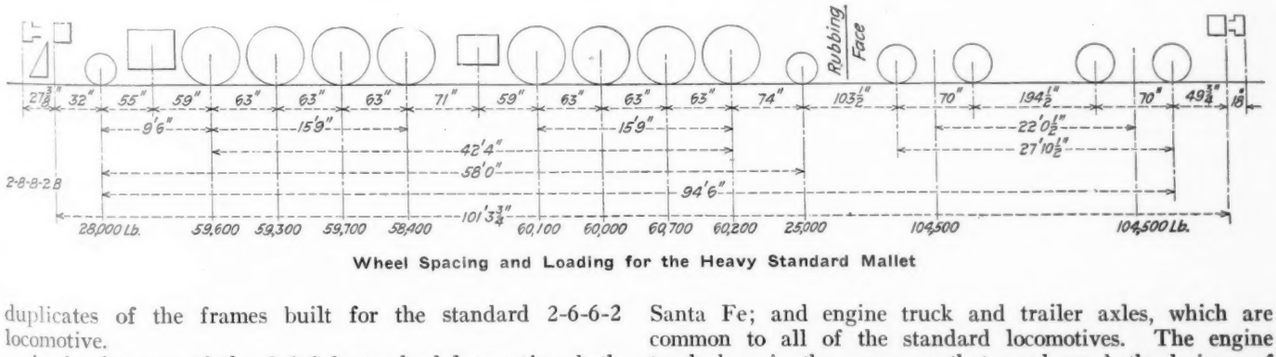
As in the case of the 2-6-6-2 standard locomotive, both the high and low pressure cylinders are provided with piston valves. A larger diameter of valve is used, however, it being 14 in. The travel of the valve for the high pressure cylinders is 6½ in. and it is given a lap of 1 in., a lead of ⅛ in. and an exhaust clearance of ¼ in. In the low pressure cylinders the valve is double ported and has a travel of 6 in. with a lap of 1⅛ in., a lead of 3/16 in. and an exhaust clearance of 7/16 in. As in the case of all the standard locomotives the valves and cylinders are bushed with Hunt-Spiller gun iron. Both cylinders are spaced 84 in. between centers, whereas in the lighter Mallets the spacing is 85 in. As in the case of the 2-6-6-2 Mallet the Mellin type of by-pass and intercepting valve is used to control the simpling and compounding of the locomotive.

In the matter of general design the crosshead for the 2-8-8-2 locomotive is the same as that of all standard locomotives. The dimensions are also practically the same, with the exception of the piston fit, the diameter of the boss in the body of the crosshead being made eight inches instead of seven, on account of the heavier piston rod, which is 4½ in. in diameter for the 2-8-8-2 locomotive and 3¾ in. in diameter for the 2-6-6-2 locomotive. The pistons have a dished section and those for the high pressure cylinders are interchangeable with those used on the light standard Pacific and the eight-wheel switchers. The specifications require that they be made of rolled steel or cast steel. They are provided with packing rings of Hunt-Spiller gun iron. The pistons for the low pressure cylinders are, of course, not interchangeable with any others used on the standard locomotives, although they are of the same general standard design. They are made of cast steel and are of dished section, having, as in the case of the high pressure cylinders, two packing rings of Hunt-Spiller gun iron. The piston rods for both the high and low pressure units of the heavy Mallet type locomotive are 4½ in. in diameter. Paxton-Mitchell piston and valve rod packing is used on these locomotives.

The main rods of both the high and low pressure cylinders are precisely the same. They are 118 in. long from center to center and are of I-section, being 3 in. wide and 6 in. deep, with 1½-in. flanges and a ½-in. web. They are of the same design as the main rods used on the 2-6-6-2 standard locomotive, the only difference being that they are one inch longer between centers and the flange is ½ in. deeper. Thus it will be seen that rods for both these locomotives can be manufactured from exactly the same size of stock material. The design of the strap end is exactly the same, the only difference being that the rods for the 2-8-8-2 type are a little heavier than for the 2-6-6-2 type locomotive.

Among the interchangeable details of these locomotives may be mentioned the dump grate rigging, which is the same as that used on the light and heavy Santa Fe locomotives; the pilot, which is standard for all except the switchers; tires, which are common to the 2-6-6-2 and the light Santa Fe; and engine truck and trailer axles, which are common to all of the standard locomotives. The engine truck box is the same as that used on both designs of Mikado and Santa Fe and the 2-6-6-2. The front bumper is the same as that used on all except the switchers and the frame pedestal shoe, wedge, and wedge bolt are the same on all locomotives except the switchers. In addition to this there are many other details which are interchangeable with the 2-6-6-2 type.

The specialties used on these locomotives as well as on the other standard engines were enumerated on page 137 of



Wheel Spacing and Loading for the Heavy Standard Mallet

the March, 1919, issue of the *Railway Mechanical Engineer.*

The following is a list of the general dimensions of these locomotives with the principal data:

General Data	
Gage	4 ft. 8½ in.
Service	Freight
Fuel	Bit. coal
Tractive effort (compound)	101,300 lb.
Tractive effort (simple)	121,600 lb.
Weight in working order	531,000 lb.
Weight on drivers	478,000 lb.
Weight on leading truck	28,000 lb.
Weight on trailing truck	25,000 lb.
Weight of engine and tender in working order	740,100 lb.
Wheel base, driving	42 ft. 1 in.
Wheel base, rigid	15 ft. 6 in.
Wheel base, total	57 ft. 4 in.
Wheel base, engine and tender	93 ft. 3 in.
Ratios	
Weight on drivers ÷ tractive effort (simple)	3.93
Total weight ÷ tractive effort (simple)	4.37
Tractive effort (compound) × diam. drivers ÷ equivalent heating surface*	695.0
Equivalent heating surface* ÷ grate area	86.6
Firebox heating surface ÷ equivalent heating surface,* per cent	5.2
Weight on drivers ÷ equivalent heating surface*	57.5
Total weight ÷ equivalent heating surface*	63.8
Volume equivalent, simple cylinders, cu. ft	22.2
Equivalent heating surface* ÷ vol. cylinders	375.0
Grate area ÷ vol. cylinders	4.33
Cylinders	
Kind	Compound
Diameter and stroke	25 in. and 39 in. by 32 in.
Valves	
Kind	Piston
Diameter	14 in.
Wheels	
Driving, diameter over tires	57 in.
Driving journals, diameter and length	11 in. by 13 in.
Engine truck wheels, diameter	30 in.
Engine truck, journals	6½ in. by 12 in.
Trailing truck wheels, diameter	30 in.
Trailing truck, journals	6½ in. by 12 in.
Boiler	
Style	Straight top
Working pressure	240 lb. per sq. in.
Outside diameter of first ring	98 in.
Firebox, length and width	170⅛ in. by 96¼ in.
Firebox plates, thickness	⅜ in.
Firebox, water space	5 in.
Tubes, number and outside diameter	274—2¼ in.
Flues, number and outside diameter	53—5½ in.
Tubes and flues, length	24 ft.
Heating surface, tubes	3,860 sq. ft.
Heating surface, flues	1,825 sq. ft.
Heating surface, firebox	435 sq. ft.
Heating surface, total	6,120 sq. ft.
Superheater heating surface	1,475 sq. ft.
Equivalent heating surface*	8,333 sq. ft.
Grate area (with Gaines wall)	96 sq. ft.
Smokestack, height above rail	15 ft. 8⅝ in.
Center of boiler above rail	10 ft. 4 in.
Tender	
Tank	Water bottom
Frame	Cast steel
Weight	209,100 lb.
Wheels, diameter	33 in.
Water capacity	12,000 gal.
Coal capacity	16 tons

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

CO-OPERATION

BY FRANK McMANAMY

Assistant Director, Division of Operations, U. S. Railroad Administration

It has been generally understood that the government assumed control of the railroads because of the necessity of increasing their efficiency and operating them in such a manner that the necessary transportation would be provided to enable the country to successfully conduct the war against what had come to be recognized as the enemy of civilization.

It had been demonstrated that under individual control it was not possible to obtain the degree of co-operation necessary to bring about the increased efficiency which must be obtained and that only by operating the railroads as a single system under the direction of a strong central organization could the transportation needs of the country be met.

A survey of the situation showed that one of the principal, if not the principal, needs was to improve the condition of motive power and rolling stock.

Greater efficiency in this respect could only be secured by greater efforts and closer co-operation of the army of the railroad shop employees, because with the urgent demands for men for military service and for munition factories it was not possible to increase the forces in proportion to the increased work. The results of the past year show that increased efforts and better co-operation was secured to an extent hitherto unknown. Personal convenience and comfort on the part of railroad officials and employees were alike disregarded. Sundays, holidays and vacations were unknown to most of the railroad workers for the past year or more. Every loyal man was on the job 24 hours a day and seven days a week, or as near it as was physically possible. Employees' contracts were temporarily modified with respect to shop hours and to promotions and suggestions or requests of the Railroad Administration for changes that would increase efficiency and bring about closer co-operation have been cheerfully and promptly complied with. As a result of this it is not an exaggeration to say that a degree of efficiency in operating railroad shops was reached which has never before been attained. The railroad machine has been operated at high speed and with full tonnage and the shop employees have provided the necessary equipment.

In the matter of furnishing necessary equipment to conduct transportation during the war, the railroad shop employees have gone over the top and when the records of what they have accomplished is written they will have little to regret and much to be proud of.

The war is now over and the problems incident thereto are things of the past. We have, however, confronting us problems equally important if perhaps not so urgent.

The principal requirements necessary to go from a peace basis to a war basis were, unlimited energy and unceasing effort. To change the shop organization from a war basis to a peace basis, which is the task that confronts us now, will require unlimited patience, tact and judgment. A degree of co-operation equal to that which has been exercised during the war will be required. It will require the principle of the square deal to be recognized and observed on all sides and it will require absolute confidence that the necessary reorganization will be worked out with fairness.

The railroad shop employees with the co-operation of the officials, have performed a great service in their work during the past year, but it could not have been accomplished without complete co-operation and confidence in those who were directing the work. They have before them during the reconstruction or reorganization period an opportunity of performing an equally great service and if that is to be successfully performed it will require the co-operation of all and the work must be done in a way that will inspire confidence.

During war times two points in the operation of railroads predominated; namely, safety and efficiency, and others where they in any way adversely affected these could in a measure be disregarded. In times of peace safe and efficient service must be rendered to the public at a cost commensurate with the service performed. This, of course, means readjustments of hours and reorganization of forces, but this can and should be done along reasonable lines with proper consideration for the rights of the public and of the employees. If approached in the proper spirit and carried out with absolute fairness, necessary readjustments can be made without friction and without loss of efficiency.

The spirit of co-operation and the desire for performing constructive work which has been manifest during the past year is a sufficient guarantee that this will be done.

SWEEPINGS FROM SHOPS.—Attention has often been called to the importance of combing the sweepings which are hauled from the various shops, roundhouses, storehouses, etc., to the refuse car and taken out along the line and dumped. Yet there is reason to believe that there is much waste bound to accrue from lax methods in caring for the sweepings and an occasional inspection and renewal of instructions is worth while.—*Railway Storekeeper.*

MAINTENANCE OF FREIGHT EQUIPMENT *

BY H. L. SHIPMAN
Equipment Inspector, A. T. & S. F.

During the past year the maintenance of freight cars has been influenced by new conditions, due to the general pooling of equipment. This change is particularly noticeable in the box car. Formerly there was a normal percentage of from 35 per cent to 40 per cent of the box cars on the home lines. At the present time this percentage has fallen as low as 7 per cent to 12 per cent. Thus each road has less control over the maintenance standard of its own equipment. It would seem that some standard of maintenance should be established and all roads compelled to keep all freight cars on their lines up to that standard. This percentage should undoubtedly be higher than the standard now maintained by many of the smaller railroads, but some method should be devised to force all roads to come up to this standard. Unless this is done, under present conditions, the average standard of all cars will fall lower, and those roads, which under normal conditions would maintain this standard, will be helpless to keep it up.

There is a limit to the maintenance of equipment beyond which it is not practical or economical to go. If it were possible to maintain all freight equipment in 100 per cent condition, it would not be economical because there are many commodities that can be handled just as efficiently and satisfactorily in a car in fair condition as in one in 100 per cent condition. Since all cars in service are continually wearing out, or deteriorating, all that can be hoped for is to maintain in good condition a sufficient number of cars to handle the commodities that require a first-class car.

There are certain kinds of freight that require a box car, others a refrigerator, stock car, tank car or gondola and other freight may be handled just as well in several of the different kinds of freight cars. Some ladings require the cars to be in first-class condition and others only in fair condition. For example, a box car to handle grain, flour, sugar, or groceries, should be in the best condition possible. The siding must be tight, the roof non-leaking, and the floor and lining level and smooth, so as not to chafe or injure the contents. Wool, raw cotton, hay, brick, etc., may be handled in a car in fair condition without damage. A leaky roof or open siding will not injure these articles, and they cannot fall through cracks in the floor as would bulk grain. The only essential for cars handling the last mentioned articles is that the frame work of the car be strong enough to hold the load and that the trucks and draft gear be in good condition.

A refrigerator car must always be in good condition in order to protect its lading, due to the fact that the requirements of this service are very rigid. A stock car should be in good condition in order to handle live stock without damage, but the same car in fair condition will haul barreled goods, rough lumber, ties, lump coal, and many other articles, very satisfactorily. A gondola must be in very good condition to hold slack coal without loss, but will hold lump, coal, coke, scrap iron, etc., if in only fair condition.

On a typical western road there was a total of 1,240,324 car loads of revenue freight handled during the year 1917. This freight was subdivided under five general headings, namely, Products of Agriculture, Products of Animals, Products of Mines, Products of Forests, and Manufactured and Miscellaneous Articles. The number of car loads of each of these classes of freight was as follows:

Products of agriculture	298,717
Products of animals	172,836
Products of mines	385,836
Products of forests	99,301
Manufactured and miscellaneous articles	283,634

A close analysis of this freight as a whole shows that 72.6 per cent should be handled in cars of first-class condition in order to avoid possible loss or damage due to the condition of the cars; 27.4 per cent of the freight could be handled just as satisfactorily in cars of fair condition.

An extended investigation in the train yard and in a large repair shop of the causes of repairs to freight cars disclosed the fact that only a very small percentage of freight car repairs become necessary due to "time and the elements," or, in other words, rust and decay. To make this study, the repairs to freight cars were subdivided into four general headings representing the principal parts of the car, as body, draft gear, truck and air brake repairs. The investigation showed that most of the repairs required by the bodies of these cars became necessary due to time and the elements, and the next important cause of repairs in the body was starting, stopping and switching or load shift under shock. The draft gear and truck repairs became necessary chiefly due to the starting, stopping and switching of the car. Load shift causes the ends of the car to be pushed out, and posts broken and the siding and lining broken. A very small percentage of the repairs to draft gear or trucks was necessitated by time and the elements. Nearly all of the repairs to draft gear were caused by starting, stopping and switching. The draft gear is broken or weakened by shock in switching and the trucks need repairs because of stopping, as well as shock. The items of the greatest expense in truck repairs are brake shoes, brasses and wheels. It is very seldom a truck has a broken side frame or bolster. The air brakes need repairs because of running and stopping the car.

Combining the causes of repairs of the several parts of the car, the results showed that 47.2 per cent of the repairs to cars became necessary due to the running of the car, and time and the elements; 52.8 per cent of repairs to cars was necessitated by starting, stopping and switching, and the loading and unloading of the car. The 52.8 per cent in starting, stopping and switching and loading and unloading should be again subdivided to show the repairs due to the necessary wear of starting, stopping and switching and the unnecessary wear or abuse of the car. The subdivision shows that 33 per cent of the repairs would be eliminated if no draft gear, end sills, posts, siding or lining were broken by shock and no wheels slid flat or journal cut.

The next question to be considered is what percentage of

*From a paper presented before the Western Railway Club.

the freight equipment can economically be maintained in first-class condition. As mentioned above, 72.6 per cent of the freight equipment should be in first-class condition to carry the freight of this trunk line without damage or loss due to the condition of equipment. Is it feasible or practical to maintain this percentage as a standard of condition?

In a recent survey of bad order cars on several of our Western roads, it developed that the higher the percentage of revenue cars bad order on any line, the more men were employed per 1,000 revenue cars on the line, and the greater was the percentage of revenue cars that were repaired each month. Conversely, the lower the percentage of revenue cars bad order on the line, the smaller was the percentage of cars repaired each month. Comparing four of these roads, and averaging two of the higher and two of lower percentages, the results were as follows:

	Per cent of revenue cars, bad order	Per cent of cars repaired to revenue cars on line per month	Number car men employed per 1,000 rev. cars on line	Total number cars repaired per month	Number revenue cars on the line
Two higher ..	8.4 per cent	135.4 per cent	76.8	53,248	43,303
Two lower ...	3.0 per cent	59.4 per cent	37.7	25,909	37,443

Very few roads have a very high percentage of their own cars on their line. The freight car is common property today, therefore, it cannot be supposed that there is any very great difference in the physical condition of the cars on these four roads. These figures simply mean that different roads have different standards of maintenance, and that a road with a high standard will endeavor to keep the condition of freight equipment to a higher standard than the other road. In order to accomplish this end, the one road hires more men and consequently bad orders and repairs more cars than the other. These roads with the high standards of maintenance have found that the old saying "a stitch in time saves nine" is just as true when applied to a freight car as in its original application, and that the net results will show up on the credit side of the balance sheet.

A road with a high standard will cut down train delays and damage claims due to defective equipment, and as a result will pay a greater dividend than the road with the low standard of maintenance. A shipper prefers a road with a high standard of maintenance because he knows his products will receive better attention than on a road with low standards. There will not be the delays en route and the goods will arrive in better condition.

One step toward distributing repair work among all railroads so as to overcome the present practice of one road making only light repairs and another doing the substantial work, would be to have a standard classification of repairs. This would make it easier to judge work done and the output. I would recommend the following outline as a reasonable classification for the subdivision of repairs:

CLASSIFICATIONS OF REPAIRS TO FREIGHT AND WORK CARS

HEAVY REPAIRS

One or two pair draft timbers.
Two or more sills renewed or spliced.
One or two end sills.
Two or more side or door posts.
One-half or more outside sheathing renewed.
Entire roof relaid or renewed.
Flooring renewed or repaired.
Door rehung or new doors applied.
Car trussed up and body tightened.
Two trucks given general overhauling.
Cars repainted and stenciled.
(Any seven or more of above items constitute heavy repairs.)

MEDIUM REPAIRS

One or two pair draft timbers.
One end sill or new end and siding.
One pair draw sills spliced.
Roof relaid or new roof applied.
Door rehung or new door applied.
Trucks repaired.
Cars trussed.
All new work painted.
(Any five or more of above items constitute medium repairs.)

RUNNING REPAIRS

Uncoupling attachments repaired.
Grab iron renewed or repaired.
Brasses applied.
Brake shoes renewed.
Running boards repaired.
Brake connection and lever.
Side door rehung.
(Any one or more of above items, or similar thereto, constitute running repairs.)

LIGHT REPAIRS

One or more pair wheels renewed.
Draft timbers tightened and new bolts.
Side door rehung.
Couplers renewed.
Body tightened.
Deadwoods repaired or renewed.
Brake beams repaired or renewed.
(Any one or more of above items or similar thereto constitute light repairs.)

It is my opinion that such a classification will be more satisfactory than to have heavy, medium, light and running repairs subdivided on a money or hourly basis. The objection to the hourly or money basis of subdivision of repairs is that no record is kept of the cost of either labor or material on individual cars. To keep these records would entail a great addition to overhead expense. The proposed plan can be used without any addition to the present clerical force.

In conclusion, the question of freight car repairs may be summarized as follows: Freight equipment should be maintained in approximately 75 per cent condition in order to handle freight without danger of loss or damage due to the condition of the freight equipment; this percentage condition cannot be maintained without the co-operation of all roads, because the freight car today is common property so far as service is concerned.

DISCUSSION

H. H. Harvey (C. B. & Q.): The statement is made in Mr. Shipman's paper that 72.6 per cent of all freight cars should be kept in first-class condition. I question whether it is necessary to have that figure quite so high. It would vary greatly on roads in different localities and will even vary on the different divisions of a single large road. There are many commodities that should never be loaded in a first-class car. One of the worst abuses prevalent on our railroads today is loading hides, fertilizer, immigrant outfits and similar material in first-class equipment. Car men in general are dilatory about calling attention to the abuse of cars. Since cars have been loaded up to the capacity of the axles there has been a great deal of overloading of light cars, and I think the sooner we get back to the 10 per cent overload, the better it will be for the equipment.

J. H. Milton (C. R. I. & P.): The only way that a car can be kept in service with the heavy tonnage handled at the present time is by reinforcing it. When we can get a system in force throughout the United States that will make all the roads reinforce their cars we will get good equipment. Until that is done we will simply repair the cars from time to time and get nothing from our labor. The majority of railroads are spending $50 to $75 to repair cars which only move off the repair track to become bad order again within a week or two. By spending $400 or $500 on these cars they could be put in first-class condition. The equipment is getting worse every day, particularly on the Eastern lines.

F. P. Schultz (Chicago Car Interchange Bureau): The designs of cars are so varied that it is practically impossible to keep a stock of the proper material for reinforcing these cars away from the home road. The Railroad Administration is now moving cars in bad order to the owning roads, and when they get home it is to be hoped that some rules will be formulated that will keep the car on the home road if it is not up to a certain standard. As far as the box car is concerned, I think as long as it is of a design that is kept in general service, it should be maintained in 100 per cent condition. A rough freight car may be given a load that it will carry, but when it is unloaded it may be in a district where there is nothing but grain loaded and the rough freight car will bring back the load of grain which it is not fit to handle. The proper way to handle the rough freight car is to mark it bad order if it is sent out under load.

W. G. Wallace (American Steel Foundries): We have heard a great deal about what has been accomplished by the united efforts of the men in the different regions in handling traffic. Would it not be a good idea to have the transportation men keep more closely in touch with the mechanical men and to prevent car repairs, instead of having so many cars bad ordered? There are a good many things that could be done by getting the transportation officers more interested in the mechanical department problems.

Mr. Milton: I believe the type of underframe required under cars depends largely on the type of draft gear. If a friction draft gear is used the entire shock is thrown on the draft sills. After a spring gear has traveled 1¾ in. the coupler strikes the dead wood and the shock is distributed on all the sills. This takes the load off the draft sills to a certain extent, and for that reason I think it is useless to have a heavy underframe under cars with spring gear.

G. S. Goodwin (C. R. I. & P.): I agree entirely with what Mr. Milton has said. Incidentally, it might be of interest to note that mechanical department circular No. 8 provides that draft sills must be constructed to accommodate friction draft gear, and also that the coupler shall be applied with 3 in. clearance between the coupler horn and the deadwood. The circular permits the application of two classs G draft springs which have a travel of about 1⅞ in. That means that the spring gear must take all the shock, since the horn of the coupler is 1⅛ in. away from the dead wood. It is easy to see what will happen under those conditions.

E. H. Hall (C. G. W.): I do not see how there can be much improvement in the condition of equipment as long as the present rules are enforced. Order No. 12 states that Interstate Commerce Commission Accounting rules must be observed. These rules provide that when the cost of repairs exceeds the major portion of the cost of the car to the carrier, the equipment must be retired. With the present high cost of labor and material the cost of repairs often exceeds 50 per cent of the book value, particularly when equipment has been acquired second hand or through receivership. To get such cars back into service requires additions and betterments which are chargeable to the corporation. It seems that the only thing to do in such cases is to put the cars on a side track until the Railroad Administration or the corporation can agree on the distribution of cost.

F. C. Kroff (Pennsylvania Lines): We have filed the inspection report on a considerable number of cars and have them set aside awaiting disposition. Up to the present time we have received no instructions from the Railroad Administration regarding this equipment.

C. J. Juneau (C. M. & St. P.): We are holding about 200 cars between Minneapolis and Milwaukee awaiting disposition and many more are coming in.

REINFORCED CONCRETE GONDOLA CAR

New Aggregate Used; Design Incorporates Steel Center Sills with Reinforced Concrete Body

AN innovation in railway equipment is a reinforced concrete car of the gondola type, invented and designed by Joseph B. Strauss, C.E., president of the Strauss Bascule Bridge Company and recently built by the R. F. Conway Company, Chicago. The plans for the car were drawn up several years ago and patents were secured covering the important features of the design. The actual construction was started during the war when it was thought that it might be possible to relieve the car shortage materially by developing concrete construction.

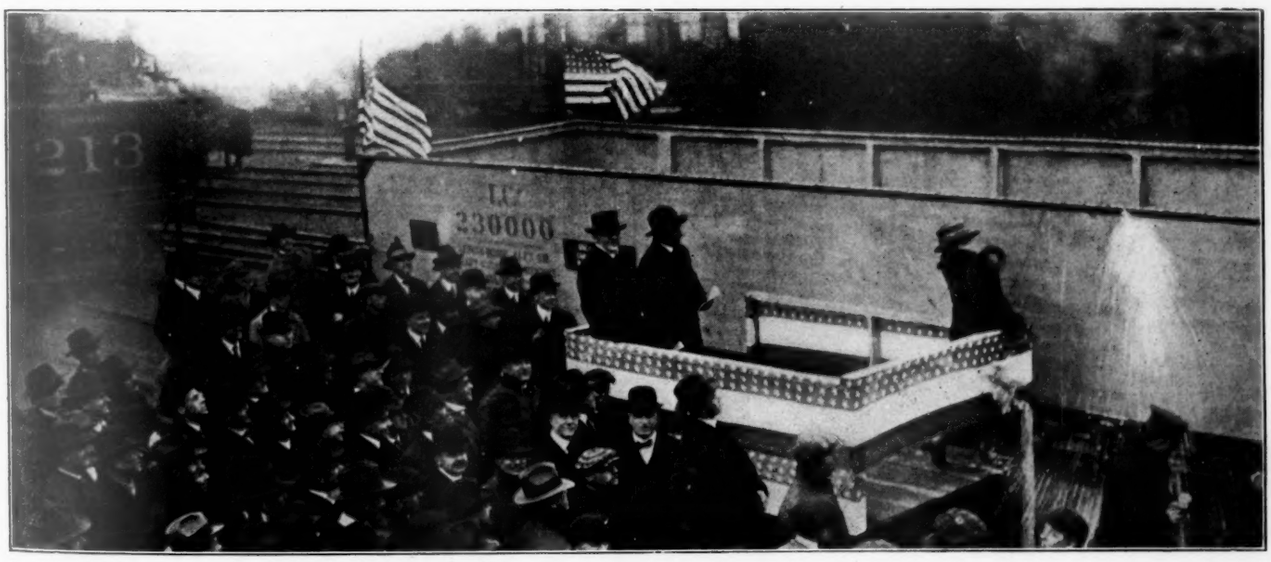


Photo. by International Film Service.

The Christening of the World's First Concrete Freight Car

The fundamental feature of the design is a steel skeleton body mounted upon the standard center sills and bolsters of the U. S. R. A. 40-ft., 50-ton gondola car. Concrete walls and floors are contained within the skeleton steel frame and together with the reinforcement in the floor are connected to the underframe in such a manner that the buffing and pulling stresses are distributed throughout the car body. The car was designed for a capacity of 100,000 lb. plus the usual 10 per cent overload. The end load was assumed at 200,000 lb. with an allowance of 25 per cent for impact, equivalent to an end load of 250,000 lb. The unit stresses in the steel were limited to 16,000 lb. per sq. in., and in the concrete to 1,000 lb. per sq. in. The gondola type was chosen for this experimental concrete car because equipment of this type is subjected to the severest handling. Dumping devices were omitted merely to simplify the construction, but this feature can be incorporated in such cars without any difficulty.

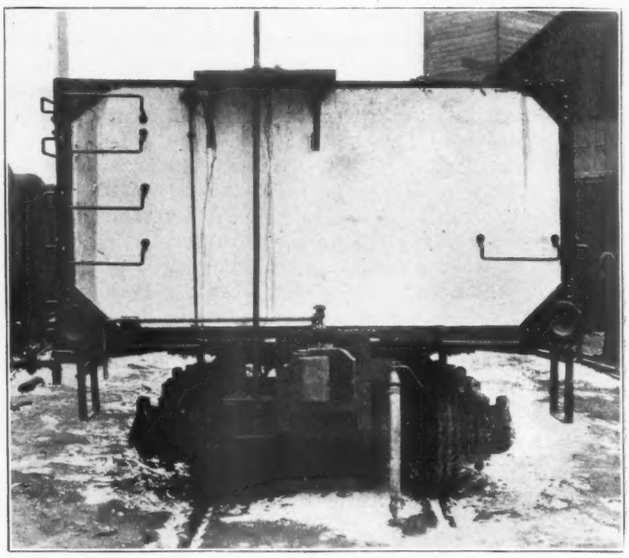
The car has an over-all length of 41 ft. 6½ in., and over-all width of 10 ft. 2⅞ in., with sides 4 ft. 10½ in. high. The steel members of the underframe consist only of the

center sill, which is of two 12-in. 35-lb. ship channels, with a ¼-in. by 20½-in. cover plate, and the body bolsters and diagonal corner braces, which conform to the U. S. R. A. standard design. There are six reinforced concrete cross bearers in the car spaced approximately 4 ft. 6½ in. apart. The size of the section varies from 4 in. by 12 in. at the sides to 4 in. by 1 ft. 4⅛ in. at the center sill. The floor is 2⅛ in. thick, reinforced with longitudinal and transverse

Interior of the Car Body

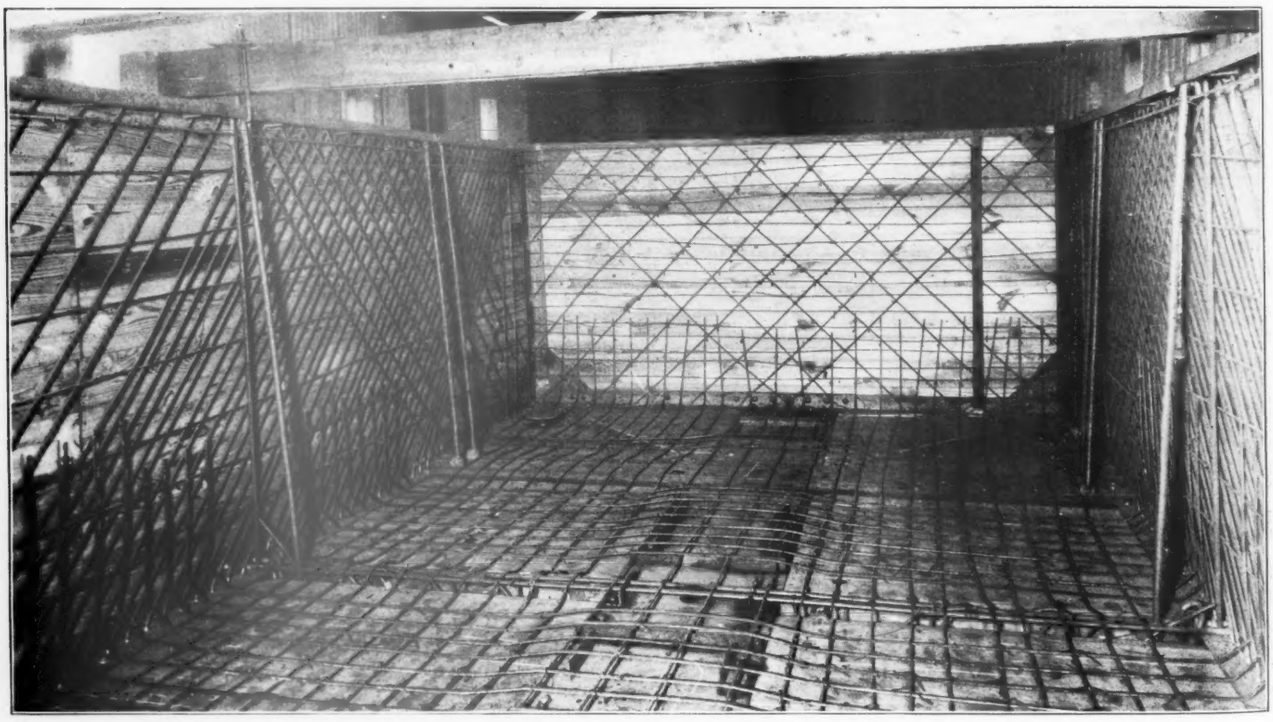
rods ¼ in. in diameter. Along the outer edge of the floor is a 3½-in. by 3½-in. angle and at the top of the sides there is a 4-in. channel. This steel frame serves as the tension members of the truss and also furnishes a means of attachment for the reinforcing, the side reinforcing rods extending through holes drilled in the angles and channels. The sides are 1¾ in. thick and are strengthened at the bolsters and at the cross bearers by reinforced concrete posts.

weight of 104 lb. per cu. ft., and a compressive strength of 4,450 lb. per sq. in. in 28-day tests. It is the result of a manufacturing process developed by Stephen J. Hayde, of Kansas City, Mo. The concrete sections in this car are



Brake Staff End of the Reinforced Concrete Car

thinner than have ever before been attempted in similar work and for that reason it was decided to use the cement gun for the walls and floors. The cross bearers, however, were poured in the usual manner. The forms were placed



Skeleton Steel Frame and Reinforcing in Position in the Forms

Across the end of the car there is a reinforcing rib 6 in. by 1¼ in. located 1 ft. 11¾ in. from the floor. A diagonal rib extends up to the end from the lower end of the body bolster.

The concrete work on this car represents the first commercial application of a new light weight aggregate known as Haydite. This material produces a concrete having a

on the outside of the car and the skeleton frame and reinforcing were put in position as shown in the illustration. The concrete was then shot on from the interior. The resulting concrete was exceedingly dense and the finish remarkably smooth on the surface which was against the form. The interior was left practically as produced by the gun.

The use of the cement gun increased the specific gravity of the concrete above that computed. This fact, together with the necessity for using heavier steel sections than required in some cases brought the total weight of the car up to 53,600 lb., or 3,600 lb. more than the computed weight. It is evident, however, that with proper facilities for construction another car of this size and design can be made to weigh between 46,000 and 48,000 lb. The conditions under which the first car was built did not permit of certain refinement of design and details of construction, but the plans as now developed for commercial production of such cars have been so advanced that future cars will represent a reduction in weight, simplification of manufacture and lower cost.

This car was built with the sanction and co-operation of the United States Railroad Administration, and it was inspected during construction by J. J. Tatum, supervisor of car repairs. It was turned over to the Illinois Central Railroad on March 17, to be used on that line 30 days, after which it will be delivered to the United States Railroad Administration for such service as it may be desired to place it in. Meantime the further development of the concrete car will be handled by the Concrete Car Company of America, Chicago, which has plans completed for manufacturing concrete cars on a commercial scale.

One of the photographs was taken during the christening ceremonies with which the car was launched upon its career of railroad service, a consideration probably not accorded to any of the other more than two million existing freight cars.

THE AUTOMATIC STRAIGHT AIR BRAKE

I. C. C. Reports Successful Operation in Extensive Tests With and Without Other Types of Brakes

THE Interstate Commerce Commission on March 4 submitted to Congress the report of a series of tests conducted by the Bureau of Safety of the air brake system of the Automatic Straight Air Brake Company of New York, as a result of which the bureau submitted the following conclusion: "In the tests of the automatic straight air brake system, both Westinghouse and automatic straight air locomotive apparatus was used with trains made up of various arrangements of Westinghouse and automatic straight air triple valve equipment, and the tests were made under varied operating conditions. Synchronous operation of the automatic straight air brake system with brake apparatus now in common use was secured in all of these tests. On trains equipped entirely with automatic straight air triple valves the reliability and flexibility of the automatic straight air brake system were sufficiently demonstrated." This conclusion, together with a report submitted to Congress June 29, 1916, is the result of a study and test of this system during a period of several years, beginning in 1910, when the triple valve was presented to the Block Signal and Train Control Board, and including experimental tests on the Atchison, Topeka & Santa Fe in 1915 and extensive rack tests and service tests on the Virginian Railway during the period from March to July, 1918.

The apparatus recently tested is a development of that formerly controlled by the California Valve & Air Brake Company of Los Angeles, Cal., tests of which were made by the bureau in November, 1915, which were the subject of the report to Congress in 1916. The tests which are the subject of the new report were made first with the apparatus installed on a 100-car test rack in New York City and later on the Virginian Railway with the same brake apparatus installed on cars used in coal service between the mines in West Virginia and the docks at Sewalls Point, Va.

As presented to the commission for test, the apparatus comprises a triple valve, a high volume feed valve and a compensating valve. The triple valve tested is of the 3-unit type,* the three units being a service section, an emergency section and a change-over section; the equipment also includes a quick action reservoir and a service reservoir in addition to the present auxiliary reservoir and brake cylinder.

This apparatus is designed to produce essentially the following operating results:

(1) Rapid serial action in service applications and in quick release.

(2) The maintenance of uniform and constant brake cylinder pressure, irrespective of piston travel or cylinder leakage. The cylinder is fed from the brake pipe, the pressure in which in turn is maintained by the compensating valve while the brake valve is in lap position.

(3) Graduated release, permitting a variation of brake cylinder pressure at the will of the engineman.

(4) Quick release when desired.

(5) Emergency applications of the brake available at any time during or after any service application, and an automatic emergency application on depletion of train pipe pressure to approximtely five pounds.

As is suggested by the name, the design of this system combines features of the automatic air brake and the straight air brake. Apart from its use to obtain quick release of brakes, auxiliary reservoir air is used only in emergency application. In service application brake cylinder air is obtained from the brake pipe and service reservoir, the auxiliary reservoir serving as a constant pressure chamber to regulate and govern brake cylinder pressure in proportion to brake pipe reduction. The design of the triple valve is such that in a service application the build-up of brake cylinder pressure as compared with the reduction of brake pipe pressure is in the ratio of two to one.

The high volume feed valve and the compensating valve of this system form a part of the brake equipment installed on the locomotive. The high volume feed valve performs the functions and takes the place of the feed valve commonly used, the purpose of this valve being to remove any restriction between brake valve and brake pipe when brake pipe pressure is below the pressure for which the feed valve is adjusted. The compensating valve is designed to compensate for brake pipe leakage during service application, as well as for depletion of brake pipe pressure by action of the triple valves in automatically compensating for brake cylinder leakage; its function is to maintain brake pipe pressure equal to the equalizing reservoir or chamber *D* pressure. It will also perform the equalizing discharge valve functions.

TESTS ON VIRGINIAN

The report includes a description and analysis of standing and running tests on the Virginian Railway from June 4 to July 9, 1918.* In the first tests, series A, the entire 100 cars were used and tests were made before the brake equipment was changed in any respect. When the A. S. A. equip-

*For a detail description of this equipment see the *Railway Mechanical Engineer* for November, 1917, page 633.

*For a description of the test equipment and an account of the final test runs from Princeton to Sewalls Point, see the *Railway Mechanical Engineer* for August, 1918, page 453.

ment had been installed on 10 cars, standing and running tests were made, series B, with a train of 50 cars, 40 equipped with the original Westinghouse equipment and 10 with A S. A. equipment in blocks of four Westinghouse and one A. S. A. In series C, standing tests only were made with 90 cars, 81 equipped with Westinghouse triple valves and 9 with A. S. A. equipment, in blocks of nine Westinghouse and one A. S. A. In series D, E and F a 50-car train was used, 25 cars having each type of triple valve equipment. In series D the cars were arranged in blocks of five Westinghouse and five A. S. A.; in series E and F, the cars of each kind were grouped together, in one case with the A. S. A. ahead and in the other with the Westinghouse ahead. For the standing tests, series G, a 100-car train was used, 81 cars equipped with A. S. A apparatus and 19 with Westinghouse, with the latter on every tenth car and on cars 20 to 30 inclusive. In series H all cars were equipped with A. S. A. triples, and standing tests were made with two trains consisting of 50 and 100 cars, respectively, and running tests were made with a 50-car train. In series I, 100 cars were equipped with A. S. A. apparatus; standing tests were made and the train was run from Princeton to Roanoke. At Roanoke the A. S. A. triples were removed from 50 cars and replaced by the original Westinghouse K-2 triples for the series K tests, which consisted of a test trip from Roanoke to Victoria with the first 49 cars and the rear car equipped with A. S. A. apparatus. Series L consisted of a trip from Victoria to Sewalls Point with the Westinghouse cars ahead. In all, the schedule included about 70 tests, standing, terminal and running.

In series A, brake cylinder leakage tests and retaining valve tests were made for the purpose of securing a record of the condition of the brake equipment. The purpose of the tests in series B, C, D, E, F and G was to demonstrate the operation of both types of triple valves in trains of mixed brakes with and without the A. S. A. engine equipment.

The purpose of the test run from Princeton to Roanoke was to demonstrate the ability of the A. S. A. brake equipment to control a long train on heavy grades, as well as the flexibility of the system for controlling a train on undulating and level grades.

Leaving Princeton, the A. S. A. locomotive apparatus was in service, and on all cars the brakes were operated in graduated release. In making the first brake application after starting down the grade, three brake pipe reductions were made, the total reduction being from 87 to 70 pounds, as indicated by gages on the locomotive; as a result brake cylinder pressures of 36, 29, 35 and 38 pounds were developed on the 1st, 29th, 60th and 95th cars. Following these reductions, the brake valve was not moved to release position in time to restore brake pipe pressure quickly enough and the train stopped before the brakes were released. As soon as pressure was restored the train was again started and a speed of 10 or 11 miles per hour had been attained when an emergency application occurred, due to an air hose being blown off from the 94th car. The train did not part, and was stopped without shock on either end. When the hose had been replaced and pressure restored, the train was started and a reduction of brake pipe pressure from 86 to 70 pounds was made for the purpose of controlling speed. Following this application, as the brakes were being graduated off when speed had been considerably reduced, the train parted, due to the coupler on the 85th car slipping over the top of the coupler on the 84th car, the carrier iron having fallen. This caused an emergency application; and although the speed was very low both portions of the train stopped without shock. Repairs were made and the train proceeded to Kelleysville without stop; the brakes were applied and graduated off and on as required to control the speed, which varied from 16 to 22 miles per hour. No difficulty was experienced in controlling the rate of speed, and the operation of the train was notably free from shock.

At Kelleysville the brakes on all cars were placed in quick release and the train was operated with brakes in that condition from Kelleysville to Whitethorne. Approaching the New River bridge as the brakes were being released following an application, the train parted between the 66th and 67th cars on account of a broken knuckle. The emergency brake application brought both portions of the train to a stop without damage or shock. Again, approaching Rich Creek the train parted between the 89th and 90th cars, due to a broken knuckle, while the brakes were being released, and the brakes on the head end back to about the 60th car had been released. Brake pipe pressure having been restored at the head end, higher brake cylinder pressure on the cars at the head end was built up in the emergency application than on the cars farther back. Notwithstanding this emergency application originated near the rear end, serial action of the brakes from that point to the head end was so rapid that the higher brake cylinder pressure developed on the head end stopped that end of the train first, causing a rather severe run-in of slack. However, the shock was not severe enough to cause any damage and when the coupler had been repaired the train proceeded.

At Whitethorne the brakes of all cars were again placed in graduated release. After passing Merrimac the first two applications of the brakes which were made on the grade east of that point were heavy, and each time the train was stopped before the brakes were released. Subsequently lighter brake applications were made and the speed of the train was controlled properly.

At Roanoke the A. S. A. triple valves were removed from 50 cars and the Westinghouse triples were replaced. On the trip from Roanoke to Victoria the train was made up with the first 49 test cars and the rear test car equipped with A. S. A. apparatus and cars 50 to 99, inclusive, were equipped with Westinghouse triple valves; from Victoria to Sewalls Point the first 50 test cars were equipped with Westinghouse triples and the last 50 with A. S. A. The purpose of these arrangements was primarily to determine what, if any, slack action there would be between cars with different types of brake apparatus grouped together in large numbers in different parts of the train and whether proper synchronous and serial action would be obtained under varied braking conditions encountered.

The trip from Roanoke to Victoria was made on July 8. Leaving Roanoke the brakes on 49 A. S. A. cars were operated in graduated release. On the grade between Goodview and Huddleston very light brake pipe reductions were made for the purpose of controlling speed, the reductions varying from two to four pounds each. At Stone Mountain approximately half-way down the grade, the train was brought to a stop to meet an opposing train. From that point it proceeded to the bottom of the grade without a stop, the operation being remarkably smooth and free from shock.

At Taber, 54 miles east of Roanoke, the brakes on the A. S. A. cars, except the first 25, were placed in quick release and the trip from Taber to Victoria was completed with the brake apparatus in that condition. Near mile post 129, about 9 miles west of Victoria, while running at a speed of about 20 miles per hour, the train parted between the 99th and 100th test car, due to a short knuckle pin and the top coupler lug being broken off. Before the break-in-two the brakes were not applied. The emergency brake application brought it to a stop without damage or shock.

The run from Victoria to Sewalls Point was made on July 9. A box car loaded with equipment and tools was hauled next to the locomotive, and there were four cabooses on the rear end; the brakes on the cabooses were not used. Approaching Purdy, approximately 40 miles east of Victoria, there is an ascending grade eastbound of .2 per cent

followed by a descending grade of .21 per cent for a short distance and then by a descending grade of .5 per cent. Approaching Purdy an application of the brakes was made and before the rear end had reached the crest of the ascending grade, the head end being on the descending grade, the brake valve was placed in full release position for a period of nine seconds and then returned to running position. The train parted between the 82nd and 83rd cars, the knuckle on the rear end of the 82nd car being broken. Trainagraph charts indicated that prior to the break-in-two the brakes had been released back to about the 50th car, and it is apparent that the contour of the line, together with the short release period and a bad flaw in the knuckle caused the break-in-two. After the knuckle had been repaired the trip to Sewalls Point was completed without noteworthy incident.

DISCUSSION

In the discussion of the tests, the report says the A. S. A. brake equipment is considered, first, as used in mixed trains with other types of brake apparatus now in common use, and, second, when A. S. A. brake equipment exclusively was used in the test trains. In mixed trains, in both standing and running tests, synchronous operation with the Westinghouse apparatus was obtained, and the control of mixed trains having a large percentage of A. S. A. triple valve equipment under varied braking conditions, including heavy, undulating and level grades, was, with but one or two exceptions, notably free from shock.

The design and construction of the A. S. A. triple valves used in the Virginian tests provided for low brake cylinder pressure for a given brake pipe reduction, as compared with the Westinghouse triple valves, particularly in view of the short piston travel maintained on the Virginian Railway. In mixed trains better braking conditions would be provided and more harmonious operation with other types of brake apparatus if the A. S. A. brake provided higher brake cylinder pressure in proportion to brake pipe reduction. It is noted that this is merely a detail of construction and an increase in the present ratio can easily be obtained.

In mixed trains with the A. S. A. triple valve equipment on the head end the functions of graduated release were accomplished and tests demonstrated that the graduated release feature of the A. S. A. triple when used on the head end of mixed trains is very desirable under operating conditions similar to those encountered on the Virginian Railway, also emergency operation of the A. S. A. cars on the head end of mixed trains was obtained following a service application when the initial reduction was not too great. The use of A. S. A. triple valves in mixed trains on account of locally reducing and increasing brake pipe pressure results in some degree in more positive operation and an improvement in serial action both in applications and in releasing the brakes, the degree being dependent upon the number and location of the A. S. A. triple valves in the train.

On cars equipped with A. S. A. apparatus, the A. S. A. triple valves supplied comparatively uniform brake cylinder pressure which was not affected by piston travel, brake cylinder leakage or pressure retained in the brake cylinder at the beginning of an application; but under present practices of controlling trains the brakes ordinarily are not held applied long enough to obtain the full advantage in mixed trains of compensating for brake cylinder leakage.

In the standing tests with trains having all cars equipped with A. S. A. triple valves, practically all the intended functions were accomplished. In general, proper serial action in both application and release was obtained; when operating in graduated release the brakes were graduated on and off as desired, being fully released as intended when normal brake pipe pressure was restored. Comparatively uniform brake cylinder pressure was obtained regardless of piston travel or of pressure retained in the brake cylinders by the retaining valves, and it was maintained notwithstanding ordinary brake cylinder leakage. Emergency operation following a service application was not secured in every case when desired; after the installation of the special emergency valve on the locomotive, emergency operation was secured when the initial service reduction was 20 pounds or less. The emergency tests demonstrated that after a full service reduction followed by a full release period as short as 10 seconds emergency operation of the triples throughout the train can be secured. The automatic emergency feature of the triple valves tested, which becomes effective when the brake pipe pressure had been depleted to five pounds or less, was so much delayed as to be of little or no practical value; to make this feature of the brake system useful the period of time required before the automatic emergency operation occurs must be materially decreased, which can be accomplished by making this function operative at a higher brake pipe pressure. In the test providing for an angle cock on the rear end of the train to be opened with the brake valve in running position, the emergency operation carried to the head end of the 100-car train.

In the running tests on the grade between Princeton and Kelleysville with 50 and 100-car trains equipped exclusively with A. S. A. triple valves the operation of the brakes was precise and uniform and the control of the slack action during application and release of the brakes was practically ideal. The speed restriction for freight trains on this grade is 12 miles per hour, but was not observed in common practice. The test trains were in several cases permitted to attain speeds more than double the maximum authorized before the brakes were applied, necessitating a heavy brake application to control them. The pressure developed in the brake cylinder was comparatively uniform except on the head end, where high brake cylinder pressure resulted from an overcharge of the brake pipe while the brake valve was in full release position. The release of the brakes even at as low speed as two miles per hour resulted in no bad effects from slack action, but was very uniform.

In the two cases when the train parted between Kelleysville and Rich Creek the brakes had been released on the forward portion of the train and the break-in-twos occurred between cars farther back in the train on which the brakes were still applied. In neither case was there any noticeable shock or slack action at either end of the train prior to the break-in-two. At the time of these break-in-twos all of the triple valves were operated in quick release and no retaining valves were used. None of the emergency operations on the 100-car train on the trip from Princeton to Roanoke, originating at different points in the train, caused excessive shock and no damage to train or equipment resulted, notwithstanding the low rate of speed in the first two instances. After turning the summit of the grade at Merrimac, all cars being in graduated release, an excessive brake pipe reduction was made; in attempting to release the brakes the brake valve was held in full release position long enough to fully release the brakes on the head end, but the train was stopped before release on the rear end was secured. This resulted in slack running out, and a comparatively severe shock on the rear end, but this shock was not severe enough to cause any damage. When the break-in-two occurred at Purdy the brakes had been released on the first half of the train only and the rise in brake pipe pressure had barely reached the first A. S. A. car when the train parted; this break-in-two was also clearly due to improper manipulation of the brake valve rather than to any arrangement or feature of the triple valve equipment.

The A. S. A. feed valve and the compensating valve included in the A. S. A. locomotive equipment operated as designed and intended. The tests demonstrated that it was not necessary to use any special locomotive brake equipment in order to secure proper action of the A. S. A. triple

valve, but the maintaining and compensating functions of the A. S. A. triple valves can be more fully accomplished and utilized when the compensating valve on the locomotive is used. Some alteration in the detail arrangement of the compensating valve on the locomotive as used in these tests is necessary in order not to interfere with emergency operation following a service application. When the compensating valve is in service in case of the train parting or a break in train line the brake valve must be placed in emergency position to prevent depletion of the main reservoir pressure.

In the tests of the A. S. A. brake system particular attention was devoted to principles of design and the functions accomplished. Some improvements, particularly in regard to the feature of securing emergency operation following a service application, can be effected and the construction of the A. S. A. triple valve can be materially simplified. An application of the principle of automatic straight air brake valves to meet the conditions of passenger train breaking was not considered in connection with these tests, which were entirely with freight equipment.

TREATED LUMBER FOR FREIGHT CARS*

Possibility of Prolonging the Life of the Wooden Parts of Car Construction; Methods of Treating Used

OVER two billion feet of lumber and timber are used annually for the maintenance of railway freight equipment and for the construction of new cars. This represents an annual outlay for material alone of approximately $60,000,000. To this must be added, of course, an even greater expenditure for labor, steel and other material. With a view of ascertaining the service which untreated wood has given in this character of construction and with the desire also to learn to what extent it has given added service in specific cases through wood preservation, and to what extent economy would be developed by the general adoption of the practice of wood preservation, and further, as the subject is of very pertinent interest at this time, the committee felt it advisable to make this study a subject of special investigation, both through the medium of a questionnaire to all car builders and by means of personal study.

The preliminary investigation developed that there was very little information available on this subject. As it was felt that it was a matter of great importance, and that it should be gone into thoroughly and fully, a questionnaire was prepared and sent to the members of the Master Car Builders' Association.

The questionnaire covered the following information, which, it was felt by the committee and collaborators, was necessary to a thorough fundamental study of the subject:

For Car Construction—(a) Availability, cost and quality of lumber and timber. (b) Suitability and economy of wood. (c) Factors affecting the physical and mechanical fitness of wood. (d) Importance of the assistance it may be possible to render the nation and railroads by augmenting the car building program by the extensive use of wood.

TABLE 1—SUMMARY OF REPLIES TO QUESTION NO. 1

Percentage of Maintenance Due to Decay Grouped According to Expressions of Respondents (Number of Replies Given)

Type of cars	75 per cent and over	50 to 75 per cent	25 to 50 per cent	Less than 25 per cent	Indicating considerable loss due to decay	Indicating Refuting influence of decay	No reply	Total Questionnaires tab.
Ref. ...	11	7	8	3	18	5	9	61
Stock ...	4	11	9	9	14	2	12	61
Gond. ...	2	9	12	12	13	3	10	61
Flat.	1	14	7	17	8	4	10	61
Box	0	7	7	25	9	3	10	61

Note—Approximately 77½ per cent of those replying indicate that decay is decidedly an important contributing factor.

Eighty-eight questionnaires were returned representing about 75 per cent of the most important railroad systems of the country. Of these, 61 were analyzed and the replies summarized in tables published in the appendix, 21 were discarded for lack of information, and six were too late to be included in this report.

*From a report presented at the convention of the American Wood Preservers' Association held in St. Louis on January 28 and 29.

RESULTS OF INVESTIGATION

Question 1. To what extent, in general, does decay influence maintenance of all-wood and composite freight cars? (i. e., general observations from practical experience desired.) (a) Refrigerator cars? (b) Stock cars? (c) Gondolas? (d) Flat cars? (e) Box cars?

Over 75 per cent of the replies indicate that decay influences the maintenance of wooden freight equipment to a considerable extent, and only 9 per cent have given it as their opinion that decay is not a contributing factor. The indications are that conditions favorable to decay vary with the type of car, it being most predominant in refrigerator and stock cars, less in gondola and flat cars, and least in box cars.

TABLE 2.—SUMMARY OF REPLIES TO QUESTION NO. 2 (a)

a—Underframe—Parts repaired or replaced due to decay previous to the expiration of the mechanical life. Number of replies referring to each part are given.
Points of contact are chiefly referred to, i. e., mortises, tenons and enclosed areas

Type of cars	Sills in general	End sills	Side sills	Intermediate sills	Center sills	Floors or decking	Nailing strips, composition cars	Draft timbers or sills	Body bolsters	Hoppers	Cross ties
All types. ...	24	10	9	4	5	11	1	3	2	..	1
Refrigerator.	13	3	9	1	..	11	..	2	3	..	..
Stock	8	4	8	1	..	12	..	..	..	..	..
Gondola ...	9	4	4	3	1	10	..	..	..	1	..
Flat	9	2	3	2	..	9	1	..	..	..	..
Box	2	3	10	..	..	..	..	..	..	..	..

Note—Sixty questionnaires analyzed. Two gave no reply to Q. 2-A.

Question 2. What portions of these various types of cars are most affected by decay? (i. e., where is decay the direct cause for replacements and repairs, or indirectly the cause of mechanical failure due to the weakening of certain parts resulting from attack by decay? (a) Underframe (name parts)? (b) Superstructure (name parts)?

(a) Over 95 per cent of the replies specify sills and about 90 per cent state that floors or decking of refrigerator, stock and open cars are replaced because of decay. The predominating opinion is that the points of contact are chiefly affected and weakened to such an extent as to cause mechanical failure of the entire parts. (b) Posts and braces, roof boards and siding at the points of contact, appear to be most affected. Other parts mentioned which are subject to failure due to decay are: Running boards, saddles, side and end plates, ridge poles and purlines.

Question 3. What species of wood do you employ for the following parts of refrigerator, stock, flat, gondola and box cars? (a) Draft timbers? (b) End sills? (c) Side sills? (d) Intermediate sills? (e) Flooring? (f) Posts? (g) Siding? (h) Lining? (i) Ridge poles? (j) Purlines? (k) Carlines? (l) Side and end plates? (m) Roof deck?

The prevailing practice is to require oak for draft timbers, end sills, posts and braces. Douglas fir and Southern yellow pine are generally used for all other purposes. The pine predominates owing to the nearness of the plants to the source of supply. In new construction, steel is very largely used in center sills, and to some extent for side sills and for draft rigging.

Question 4. What service records have you which are available for the study of this subject? (a) Natural life of untreated car material (name parts).

Ninety-three per cent of the answers stated "No record." The remainder reported as follows: Sills, five to eight years; roofs, four to six years; flooring (stock cars), four to six years; posts and braces, six to eight years.

TABLE 3.—SUMMARY OF REPLIES TO QUESTION 2 (b)

b—Superstructure—Parts repaired or replaced due to decay. Number of replies mentioning each part given.

	Posts and braces	Roofs, decks or roof boards	Ridge pole and roof nailers	Hatches and ice boxes	Running boards and saddles	Side-plates	Siding	Sheathing inside and end	Stakes	Purlines	Top plates
All types...	31	14	4	..	5	7	9	2	..	1	3
Refrigerator.	8	7	..	6	..	2	1	3	..	..	1
Gondola ...	..	..	..	..	..	..	5	..	2	..	..
Stock	9	4	..	..	..	2	1	..	..	..	..
Flat	..	..	..	..	..	..	..	..	..	..	..
Box	8	9	..	..	..	..	2	1	..	..	1

Note—Sixty questionnaires analyzed. Three gave no reply.

Question 5. Have you used treated timber in car construction? If so, state kind and character, species and treatment.

Eighty-five per cent answer "No." Fifteen per cent reply "Yes," representing 10 railroads which have used coal tar preservatives, creosote oil, paint and other proprietary products.

Question 6. What has been the experience with treated car material, if any? Please state this in detail, by reference to part and character of service.

Eighty-five per cent of the answers stated "No experience." The balance report varying experience referred to in later questions.

Question 6-A. Does the handling of creosoted material in the shops present any labor problems?

Replies from the few firms having experience indicate that labor objects to handling freshly creosoted timber. (The committee feels that this is not a serious objection as it can be overcome by proper practices.)

Question 7. What service records can you give of treated car material?

Ninety-five per cent of the replies give no information, but 5 per cent of the replies give the following records: Reply No. 48. Treated refrigerator car sills in service from three to seven years. Reply No. 30. Treated log car sills in service eight years. Reply No. 26. Treated stock car sills and flooring in service six years. All of the above treated material is still in good condition.

Question 8. If creosoted sills are employed for refrigerator, box, stock and gondola cars, can all stenciling be applied to the body of the car?

Fifty per cent of the replies state "Yes" and 15 per cent state "No." The remainder do not reply.

Question 9. If creosoted sills are employed for flat cars, would it be practical and economical to use metal numerals and signs to replace stenciling?

Over 60 per cent state it is practical. Opinion is evenly divided as to whether it is economical.

Question 10. If stock cars are built of creosoted lumber throughout, would it be practical and economical to use sign boards on both sides for all stenciling?

Over 95 per cent agree that it is both practical and economical.

Question 11. Would it be satisfactory practice to use creosoted sills, sub-flooring and roofing for refrigerator cars? If not, why?

Opinion appears to be evenly divided as to whether creosoted material may be expected to contaminate lading, but one firm with several years' experience states that such practice is satisfactory.

Question 12. What is the mechanical life of the various types of cars, as follows: (1) Wood? (2) Composite (steel underframe)? (3) Composite (steel center sills only)? (a) Box? (b) Refrigerator? (c) Stock? (d) Flat? (e) Gondola?

It is evident from the character of replies to this question that the respondents had in mind the mechanical life of the car as meaning the full period of its usefulness, from the time of construction to the time the car is "wrecked" or dismantled, as being unprofitable, disregarding the outlay of repairs expended on it or the extent to which reconstruction was necessary at any time. In this case the committee feels a more reasonable definition of "mechanical life" would be the period required in which the expenditure for repairs, with interest, equaled the original cost of the car.

Question 13. Would the use of creosoted timber in underframe and superstructure materially increase the period of mechanical usefulness of all types of cars, or any particular type?

Eighty per cent of replies say "Yes," and 20 per cent say "No."

Question 14. To what extent would the use of creosoted sills, flooring, posts, roofing, etc., reduce repairs?

Over 80 per cent of the replies indicate that treatment would reduce repairs. The percentage of saving varies from less than 25 per cent to more than 50 per cent.

Question 15. Have you had experience with the brush treatment of sills (mortises, tenons, end, etc.) with coal tar or creosote?

About 65 per cent report having experience with brush treatment. Ten different products were used.

Question 16. Have you had experience with treating car material by the open tank system (hot and cold treatment) or by dipping (short immersion) using creosote oil? (a) If so, what procedure was followed in the treatment and what preservative was used? (b) What were the results obtained, and what is your opinion of the value of such treatment?

Less than 10 per cent report experience. Only one employs the standard open tank process and states that "Such treatment very greatly increases the life of the materials treated."

Question 17. Have you employed car lumber creosoted by standard pressure processes? (a) If so, what species? (b) What specifications for treatment and preservative were followed? (c) What have been the results, and what is your opinion of the value of such treatments? (d) Have you used by any other method of treating for the purpose of retarding decay? (If so, mention material used, with results.)

But one firm reports experience with pressure treatment, having used with satisfactory results, both straight creosote and the Card process.

Question 18. To what extent would your shop practice be affected by the introduction of treating processes, and what method of preservative treatment would be the most practical, efficiency thereof considered?

TABLE 4—SUMMARY OF REPLIES TO QUESTION NO. 3

Number of references to various species for different parts given

Part	White oak	Red oak	Oak general	So. Y. pine	Fir Douglas	Maple	Norway pine	White pine	Hemlock	Fir noble	Hickory	Red gum	Spruce	Cotton wood	Tamarack	Cypress	Mal iron or steel	Total ref's to parts
Draft timber .....A	7	1	47	2	1	2	..	..	..	..	..	1	..	..	..	..	9	70
End sills .....B	8	..	44	8	5	1	..	..	..	..	..	..	..	..	..	..	..	66
Side sills C	..	..	3	46	15	..	..	..	..	..	..	..	..	..	..	..	2	66
Inter sills .....D	..	..	2	46	15	..	..	..	..	..	..	..	..	..	..	..	1	64
Flooring .....E	..	..	5	46	14	2	1	..	..	..	..	..	..	..	2	1	..	71
Posts .....F	5	2	37	19	14	1	..	1	..	1	1	1	1	..	..	..	..	83
Siding .....G	..	..	..	43	16	..	..	2	..	1	..	..	..	..	..	1	..	63
Lining .....H	..	..	..	41	12	..	5	1	3	..	..	..	2	1	1	..	..	66
Ridge poles I	..	..	1	44	14	1	..	1	..	..	..	..	1	..	..	..	..	62
Purlines .....J	..	..	2	44	14	1	..	1	..	..	..	..	1	..	..	..	..	63
Carlines .....K	1	1	26	28	11	3	3	1	..	..	..	..	1	..	..	..	..	75
*S. & E. plates.....L	2	..	29	39	12	2	1	1	..	..	..	..	..	..	1	..	..	87
Roof deck .....M	..	..	..	43	13	..	1	5	1	..	..	..	..	..	..	2	..	65
Total references to species.	23	4	196	449	156	13	11	13	4	2	1	2	6	1	4	4	12	901

*End plates usually specified oak. Side plates, pine or fir.

The majority feel that shop practice would be affected to a greater or less degree by the adoption of wood preservation, indicating that the introduction of preservative treatment would necessitate at least some changes.

MISCELLANEOUS DATA

Question 1. What experience have you had with the use of "new" species of wood in car building? (e. g., have you used Sitka spruce, noble fir, Western white fir, or other species which are not common?)

The replies showed the new species used for various parts of cars were as follows: Roofing—Western hemlock, redwood, cypress, Sitka spruce, noble fir. Siding—cypress, Sitka spruce, noble fir. End sills—gum. Lining—noble fir. Decking—noble fir. Sheathing—Port O cedar. Posts and braces—Sitka spruce.

Question 2. To what extent have you used hardwoods such as oak, maple or birch, for flooring in cars subject to excessive mechanical wear? (a) Do you consider the extra life of hardwood parts justifies the expense?

Oak and maple are generally used in ore cars and to some extent in flat and gondola cars. A few firms report use of birch, hickory and beech for such purposes, and a few use pine or fir in these types of equipment. (a) More than 70 per cent of replies indicate that extra cost of hardwood parts is justified by greater life.

Question 3. What is the average amount of car stock kept on hand at your shops or yards? (a) Is this stock stored in sheds? (b) What is the percentage of loss from warping, weathering and decay? (c) What difficulties do you have in getting car stock true to grade and properly seasoned? With what species have you had this trouble?

Reports indicate that smaller shops carry from 60 to 90 days' stock whereas those which consume over 40,000,000 ft. per year carry a 12 months' supply of soft woods and an even longer supply of hardwoods. The practice of carrying a year's supply in order that the wood may become properly seasoned before use is to be commended very highly. It is essential that wood be thoroughly seasoned where it is to be given preservative treatment. (a) Replies indicate that the general practice is to store dressed lumber, kiln-dried stock and high-grade hardwoods in sheds. (b) Three-quarters of 1 per cent on the average is the loss from warping, weathering and decay. (c) Replies indicate that in recent years increasing difficulty has been experienced in securing satisfactory grades of oak and other hardwoods.

Question 4. What efforts are made toward salvage of old car lumber at repair shops?

A general effort is apparent throughout the industry to salvage all material that can be worked over at a profit. The following instances of use for salvaged lumber are given: Old siding and lining cut into roof repairs, grain doors, coal doors, yard and snow fences. Old car sills cut into sill splices, cross-ties, engine wood, shims, car stakes, narrow gage ties, cripple posts, running board saddles, blocking, framing posts. Old roofing cut into yard fencing.

Question 5. What is the comparative life of single sheathed and double sheathed box cars of similar weight and capacity?

Three firms report the double sheathed box car has up to 25 per cent longer life than single sheathed. Four firms report single sheathed up to 50 per cent longer life than double sheathed. Four report that the life of the two classes of car is practically identical. The remainder report no figures available.

The report was signed by H. S. Sacket (C., M. & St. P.), chairman; K. C. Barth (Barrett Manufacturing Company), chairman sub-committee on Car Construction; Lowry Smith (N. P.), F. V. Dunham (Southern Pine Association), W. W. Lawson (T. & N. O.), V. R. Hawthorne, acting secretary Master Car Builders' Association, and S. W. Allen, United States Forest Products Laboratory.

TABLE 17—SUMMARY OF REPLIES TO QUESTION 15

Tabulation of replies, number who used some sort of brush treatment—what product and whether satisfactory

Brush treatment used 37		No treatment used 21	No statement 3
Number of replies	Products used	Satisfactory	Unsatisfactory
8	Creosote	8	0
2	Coal tar	2	0
1	Carbolineum	1	0
18	Paints	13	5
5	Wood tar preservatives	4	1
2	Proprietary asphalt waterproofing products	2	0
1	Carglue	1	0
37		31	6

TABLE 14—SUMMARY OF REPLIES TO QUESTION 12

WHAT IS THE MECHANICAL LIFE OF THE VARIOUS TYPES OF CARS?

Sixty-one Questionnaires Analyzed to November 5, 1918

Mechanical Life as Stated by Questionnaire

	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	25	26	28	30	35	40	No reply
Box Cars																								
Years life	..	2	3	1	..	5	..	4	1	..	4	3	..	4	..	13	1	3	..	..	4	..	..	13
Wood	..	..	..	2	..	2	..	..	..	1	2	..	1	2	..	4	..	6	1	..	4	..	1	35
Composite, steel underframe	..	..	1	..	1	1	..	1	..	..	3	..	..	3	..	4	1	4	..	..	..	..	..	42
Composite, steel center sill																								
Refrigerator Cars																								
Years life	1	4	1	1	..	5	..	1	..	1	7	2	..	2	..	2	..	3	..	..	1	..	..	30
Wood	..	1	1	..	1	..	1	5	1	..	..	..	..	..	1	1	..	1	1	..	5	1	..	41
Steel underframe	..	1	1	1	..	2	..	2	..	1	..	1	..	..	..	2	..	2	..	1	..	..	..	47
Steel center sill																								
Stock Cars																								
Years life	1	3	1	4	1	4	..	2	1	..	2	2	..	1	2	10	1	3	..	..	..	..	..	23
Wood	..	1	..	1	..	3	..	1	..	..	2	1	..	1	..	4	..	1	..	..	..	..	..	46
Steel underframe	..	1	..	1	1	1	..	1	..	..	8	1	..	2	..	2	..	4	1	..	3	1	..	34
Steel center sill	..	1	..	1	..	1	..	3	..	2	1	..	..	..	1	3	1	1	..	..	..	1	..	45
Flat Cars																								
Years life	1	3	..	4	..	9	..	..	..	3	6	1	2	2	..	7	..	4	..	..	1	..	..	18
Wood	..	1	..	1	1	1	..	1	..	..	8	1	..	2	..	2	..	4	1	..	3	1	..	34
Steel underframe	..	1	..	1	..	1	..	3	..	2	1	..	..	..	1	3	1	1	..	..	..	1	..	45
Steel center sill																								
Gondola Cars																								
Years life	3	2	..	2	..	9	..	1	..	1	9	1	2	1	..	7	..	2	..	..	2	..	..	19
Wood	..	1	..	2	..	2	..	..	..	2	2	1	..	1	..	4	..	3	1	..	3	1	..	38
Steel underframe	..	1	..	1	..	2	1	1	..	2	1	..	..	2	..	3	..	1	..	..	1	..	..	45
Steel center sill																								

Note—Where the reply stated a term of years, i. e., "from 6 to 8 years," an average of the two figures was used in summary, i. e., 7 years.

DISCUSSION

J. H. Waterman, superintendent of timber construction, Chicago, Burlington & Quincy, reported that large quantities of timber had been treated and used in the construction of stock cars during the period from 1911 to 1914, inclusive. Recent investigation at all car repair yards on the system indicated that there was no record of any of these cars having been repaired to date, because of the decay of the treated timber. This treated timber was used for floorings and sills; the average life of untreated timber for these purposes is three or four years.

L. K. Sillcox, master car builder, Chicago, Milwaukee & St. Paul, at Milwaukee, urged the treatment of car roofing timbers and the material in stock cars.

J. H. Milton, superintendent of the car department, Rock Island Lines, favored the treating of longitudinal sills, posts and decking for gondola and stock cars, but opposed the creosoting of timber for box and refrigerator cars, because of danger of injury to the lading.

CAR INSPECTION AND MAINTENANCE*

Unification Demands Capable Supervision and Inspection and the Backing of Operating Officers

BY J. J. TATUM
General Supervisor of Car Repairs, United States Railroad Administration

IT has generally been found by railroad managements that the inspection and maintenance of car equipment is not uniform and they have frequently urged unification of inspection and repairs, deeming it to be an important factor of safety, good performance and economical operation.

Unification of inspection and repairs to equipment was found by the United States Railroad Administration to be such an important requirement of good railroad performance that it soon began to lay plans and make instructions effective that would unify inspection and repairs, as well as to standardize equipment.

For this reason Circular No. 7 was issued, June 8, 1918, by C. R. Gray, former director of the division of operation, to insure that inspection and repairs would be properly made to car equipment. Mechanical Department Circular No. 7 was issued October 17, covering repairs to refrigerator cars for the purpose of standardizing the repairs to refrigerator cars to such extent that they would be suitable for the service they are intended to perform. Mechanical Department Circular No. 8 was issued November 1, 1918, for the purpose of standardizing materials for freight car repairs in order that repairs could be made promptly and uniformly.

Knowing that certain things must be done and issuing instructions to do them does not always mean they will be done, or that the instructions issued will be complied with. Something more is required. The men in charge should be capable not only of issuing instructions but capable of knowing when instructions are being complied with. They should also be capable of issuing workable instructions and selecting men who are capable of complying with their instructions.

If this statement is true then we should have thorough, capable and efficient men at the head of car departments, who know when a car is properly inspected and how to inspect it. They should know when a car is properly repaired and how to repair it. If they are capable of doing this, they should then be capable of selecting the right men to see that this work is properly performed. They should know that the foremen they have placed in charge of their repair shops are not only capable of repairing cars and knowing that they are properly repaired but that they are also capable of seeing that the men doing the work do it properly.

When selecting a man as foreman car inspector or leading inspector, it should be known that the man selected is not only capable of inspecting a car and knowing when it is properly inspected, but that he is capable of selecting men as inspectors who are able to inspect cars properly.

After these requirements are met, we may look with confidence for unified inspection and maintenance of equipment, but not until then.

Even after this is done there will still continue to be improper inspection and maintenance of equipment and a variance from the unification requirements if those in charge of these men do not respect their action. I mean by this statement that inspectors should be given all trains to inspect and they should be permitted to hold them a sufficient length of time to give each car the needed inspection and repairs, or to shop the defective car out for repairs. After a car inspector has shopped a car for defects which make it unsafe to be continued in service, no one should be permitted to cause such car to be placed back in service until the repairs for which the car was shopped have been made properly, or improper repairs corrected. One giving or assuming such authority, will by his act, become an enemy to safety and a promoter of disaster that may result in loss of life or limb and destruction of property.

It should be considered just as serious and dangerous for one to remove a shop card from a defective car and permit it to go into service without necessary repairs being made, or permit a car to go into service with a shop card on it without the repairs being made, as it would be for one to change a red signal to white before an approaching train, without knowing whether or not the block into which the train is to move is safe and clear. In my opinion, one act is just as serious and just as liable to cause disaster as the other.

Therefore, Mr. Railroad Manager, it is with you to see to it that your car inspectors are given your trains to inspect, with the time to make needed inspection and repairs. If this is not done you should be responsible for the failure of such cars and not the head of the car department or his inspector. It also lies with you to see that the car inspector's action, when shopping a car out for repairs, is given your full support, to the extent that, should anyone remove a shop card from a defective car and permit it to go into service before necessary repairs are made, or place a car in service with a shop card on it, such person should be relieved from the service for the good and safety of all concerned. If this is not done, then the motto we have established—"Safety First"—is only a mockery and you are deceiving yourself as well as the public, in your efforts to promote such a doctrine.

The protection of millions of passengers using the railroads of our country, as well as railroad employees, and the protection of billions of dollars' worth of railroad property and billions of dollars of freight hauled in cars operating over our railroads depends upon the thorough and careful inspection made to our cars. There also depends upon their careful inspection and the repairs to equipment the protection of foodstuffs needed to feed hundreds of millions of people. With this great responsibility upon the inspectors, their value cannot be discounted.

To bring about these desired conditions it is necessary that we first select for the heads of our car departments men who have been thoroughly trained and well experienced. They should see to it that inspectors selected are capable of making safe and proper inspection of car equipment. This can only be established by requiring inspectors to pass an examination that will insure that after once passing the examination they are capable of performing the work assigned to them.

They should also see that inspectors are given all trains to inspect and permitted to hold them until inspection is made. Cars once inspected and passed as being fit for service should be in such condition that, when inspected again at next inspection point, they will not be shopped out for defects that existed at the time of the previous inspection; neither should they fail while in movement due to such defects. In other words, should an inspector pass a car as being safe and fit for loading at St. Louis that car should be in condition to continue through to New York or any destination without being shopped out or breaking down in movement, due to

*Abstract of a paper read before the Central Railway Club at Buffalo, N. Y., March 14, 1919.

defects existing when the car was inspected at St. Louis. When a car repaired on shop tracks at Chicago is moved to New York for loading it should not be necessary to shop it for defects that existed when it was placed on the shop tracks, or for improper repairs made at Chicago, on or before its arrival at New York. No car should be placed for loading until first inspected and given needed repairs.

Unless we are able to obtain these desirable conditions our inspection or our repairs are not uniform, or our supervisors are not capable and efficient, or someone is removing shop cards or causing cars to leave inspection points or repair yards before they are in proper condition for service.

Unless such practices are corrected (if they exist) we cannot expect to establish the unified requirements which would result in safe and economical operation. Unified inspection and repairs will mean to our railroads less loss of life and limb of passengers and trainmen, greater car mileage, fewer accidents, less destruction of equipment and property, less repeated shopping of cars, greater car supply, less need for purchase of new equipment, decrease in cost of operation, less maintenance cost, prompt handling of business, greater satisfaction to shippers, better earnings for railroads and a more satisfactory dividend for the stockholders.

DISCUSSION

In presenting his paper Mr. Tatum referred to the fact that of the more than two and a half million freight cars in the country about 125,000 cars are being held for repairs and more than 100,000 cars are being repaired per day. There are on 80 railroads, or about 57.6 per cent of the railroads reporting to the Railroad Administration, less than four per cent bad order cars. On February 15 there were 141,000 men employed in car repairs on 139 Class I railroads, which were holding an average of slightly over five per cent of their cars in bad order.

F. W. Brazier, superintendent rolling stock, New York Central, questioned the significance of the figures given by Mr. Tatum as to the number of cars actually in bad order condition, owing to the fact that instead of giving cars thorough repairs too many of them had only received sufficient repairs to get them temporarily back into service. He endorsed the requirements for unification outlined by Mr. Tatum, stating that the instructions are clear enough, but that little attention is paid to some of them; when business is rushing there is a great demand for equipment and only such repairs are made as will keep the cars running, instead of giving them the thorough repairs they need, when they are empty and on the repair track. M. C. B. Circular 4-A, now in effect, was quoted to show that it is not so much instructions that are needed as some way of securing their full observance. This circular alone, if carried out, would greatly improve the condition of equipment not now suitable to meet modern service conditions. In this connection Mr. Brazier stated that the New York Central on August 1, 1918, had 7,000 cars yet to be equipped with safety appliances. Since that time only eight cars have been reported as being equipped with the safety appliances on foreign lines, as compared with 370 foreign cars which have had the appliances brought up to standard on the New York Central Lines. The need of adequate force behind instructions, if they are to be carried out, was further emphasized by Mr. Brazier, who cited the case of the safety appliance standards now adopted and enforced by the Interstate Commerce Commission. The Master Car Builders' recommendations for the ladder location were complied with by about 85 per cent of the railroads, but the other 15 per cent of the roads persisted in applying their ladders in exactly the opposite location. The Interstate Commerce Commission did not formulate new standards, but it required the force behind the Safety Appliance Acts to bring about 100 per cent compliance with the standards formulated by the association.

The need of the highest type of supervision in the car department was emphasized, its importance being indicated by the fact that in 1917 the New York Central spent $8,000,000 in the maintenance of locomotives, whereas the car department's expenditures totaled $17,000,000. But labor conditions have been such during the past year that it has been difficult to keep men in the service long enough to develop good inspectors.

Commenting on Mr. Tatum's remarks as to the need of holding trains for thorough inspection, Mr. Brazier advocated that no car be placed for loading until it has passed a thorough inspection. Such inspection should apply particularly to the running gear, brake rigging and draft gear, which must be in first-class condition on all cars, while some other parts of the car need not necessarily be in perfect condition to receive certain classes of lading.

Mr. Brazier called attention to the air brake situation, which is one of the most serious conditions affecting the proper operation of freight cars. He suggested as a subject for investigation how many railroads have proper yard facilities for testing the brake equipment and making necessary repairs to it. Referring to this matter, Mr. Tatum mentioned an instance in which a railroad was endeavoring to economize in the purchase of material by reclaiming old cylinder gaskets, no new ones being purchased. An inspection was made of some of the brakes thus overhauled after the work had been completed and the brakes stenciled ready to return to service; the fact was disclosed that the brakes leaked off so fast that it was impossible for the inspector to read the gage quick enough to say whether they had applied or not. A question as to the proper life of air hose in its relation to brake conditions was raised by H. C. Woodbridge, regional supervisor of the Fuel Conservation Section of the Railroad Administration, who stated that it costs as much to stop a train as to renew an air hose. This was cited as an indication of the false economy of attempting to retain air hose in service beyond the period during which they may reasonably be expected to remain tight. It was suggested that if road foremen and enginemen would report excessive train line leakage these reports might serve as a means of keeping the car department advised as to tendencies in the condition of air brake equipment. L. D. Gillette, inspector of the Canadian Dominion Railway Commission, also referred to the question of porous hose as being a source of great danger to the safe movement of traffic,—the proper place to locate the porous hose being in the yard and not on the road. In reply, Mr. Tatum stated that he considered the safe life of an air hose to be about one year, and referred to the fact that the Master Car Builders' Association is now considering the formulation of rules covering the question of air brake maintenance.

R. S. Miller, master car builder of the New York, Chicago & St. Louis, raised the question as to what constitutes a serviceable car. Various interpretations of this expression are being adhered to in different localities, which causes difficulty under present conditions in the free movement of equipment. If a uniform interpretation were available it would materially assist in securing unified inspection. Mr. Miller also advocated the universal use of the Master Car Builders' rules for the examination of car inspectors rather than the individual sets of such rules instituted by various car department heads. In answer to the question as to what constitutes a serviceable car, Mr. Tatum stated that he considered a car serviceable when it was in condition to carry the class of freight for which it was built, but that this did not preclude the use of box cars not in serviceable condition for first-class merchandise to carry rough freight.

W. H. Sitterly, general car inspector, Pennsylvania Railroad, emphasized the air brake situation, stating that the brakes contribute very largely to bad car conditions. The one difficulty is that time enough is not given to the car inspector to do his work properly, and it is also necessary that

adequate time be given to making the needed repairs disclosed by the inspection. Cars should not be delivered in interchange with a clean bill of health merely to get rid of them. Facilities should be available for repairing the cars. There should be only about one and a half times the day's work ahead of the car repair forces and to keep within this figure adequate facilities and enough men must be provided. Great assistance in securing proper compliance with rules relating to car repairs in interchange has been rendered by the Railroad Administration in holding the individual responsible for failure to make needed repairs or for making improper repairs, instead of the matter being, as it formerly was, a subject for adjustment between the railroad companies involved. Mr. Sitterly referred to an analysis of 787 box cars which had been made at Buffalo to ascertain their suitability to be coopered for grain. Of these cars only 55 per cent were found fit to carry grain. He stated that this situation could be improved by using cars which were not suitable to be coopered for grain for loading such commodities as fertilizer, hides, oil, etc., which leave the car in a condition unsuitable for grain service.

In referring to Mr. Brazier's discussion Mr. Tatum called attention to Circular No. 20, which specified that when a car is repaired it should be put in service to give two years' service, barring accidents. In this connection he emphasized the need for more facilities. Operating officers and managers often complain about the condition of the equipment, but they seldom offer to furnish shop facilities adequate to carry out the amount of work which must be done to keep the cars from returning frequently to the repair tracks. It is not conducive to an ideal condition of rolling stock when a shop becomes somewhat congested with bad order cars to relieve the congestion by taking off the bad order cars without performing the work required.

T. J. O'Donnell, chief joint inspector, Niagara Frontier Car Inspection Association, referring to Mr. Tatum's statement that it should not be necessary to shop a car for defects that existed prior to the time of the last shopping, said that the Buffalo gateway had at least 1,000 loaded cars every morning, loaded from 24 to 48 hours earlier, which it was necessary to condemn, as high as 150 pairs of wheels having to be changed in one day. It is the endeavor at Buffalo to get cars through the terminal in three hours, but to do this the equipment must be in first-class condition.

A. R. Ayers, superintendent motive power, New York, Chicago & St. Louis, advocated the adoption of a regular periodical program of general overhauling of cars similar to that followed in the maintenance of locomotives. He also considered it best to allow the owning roads to handle the heavy repairs and betterments to their own equipment, as they are in a position to live up to the requirements of Circular No. 8. Furthermore, they are in a position to lay out the program for betterments to a whole class of their own equipment and then carry it out on a quantity basis rather than one car at a time. Mr. Ayers emphasized the need of carrying out such betterments by referring to a study which had indicated that steel cars or cars with steel frames came on the repair track on account of the draft gear less than once a year, whereas wood underframe cars appear on the repair track for the same class of repairs about two and a half times a year. In other words, it is a physical impossibility to repair a wood underframe car so that it will run two years, on account of draft timbers.

A question was raised if the Railroad Administration had any program in view for returning cars to the owner for such work. The difficulty of carrying out this work was indicated by the situation on the Delaware, Lackawanna & Western, which had less than six per cent of its own cars on its line, where formerly the average was 60 to 65 per cent. In answer to this Mr. Tatum called attention to the fact that cars can now be sent home at the owner's discretion when the cost of making repairs exceeds $200 and that cars on connecting lines can be sent to the home road for repairs. It is the policy of the Administration, however, that repairs be made wherever the cars are located when such repairs can be made in kind.

P. J. O'Dea, chief car inspector of the Erie Railroad, inquired as to what conditions had actually been found throughout the country and what might be expected in the future in the carrying out of betterment programs for equipment not now fully able to meet modern service conditions. In replying, Mr. Tatum called attention to the fact that the war had taxed the equipment as well as the other railroad facilities far beyond what has been considered its normal capacity. At the present time preparations are being made to carry out reinforcement programs on thousands of cars. It is, however, unreasonable to expect immediate results, as little of this work can actually be carried out within less than a year. Under present conditions it takes from three to six months to get together the material, such as center sills, bolsters, truck side frames, steel ends, etc., for a single lot of 1,000 cars. At the present time some 20 roads are preparing to reinforce about 20,000 to 25,000 cars, which will eventually result in an improvement in conditions.

INTERCHANGE OF FREIGHT EQUIPMENT*

BY J. C. O'DONNELL

The great volume of tonnage traveling through the country places upon us, the responsibility as common carriers to handle that tonnage with despatch and due care. From the equipment point of view our first duty is to be absolutely certain that our mechanical inspection and upkeep are on a basis that will insure such service. This paper has been divided to cover points that are matters of daily observation with interchange inspectors, with the intention of creating discussion in order that we may take from it ideas that we feel will improve every day conditions.

THE HANDLING OF EMPTY FREIGHT EQUIPMENT

A car before it enters into interchange must first of all become a suitable vehicle for the load it is to carry, and upon this, barring unexpected conditions, depends its subsequent movement. To meet the requirements cars should be on the following basis:

A. Cars for grain or flour loading must be perfect as to roofing, flooring, sides and ends, clean and free from odors.

B. For merchandise, or similar loading, not susceptible to immediate damage, the roof in general must be free from leaks, but ordinarily not so close as an "A" car, and the body is acceptable for such loading if in fair condition.

C. For coarse freight loading, such as lime, ingots, spelter, pulpwood, and commodities not susceptible to damage by weather, the body should be in fair condition.

D. Open-top equipment in the ore loading districts and in season must have a special inspection to see that all sides and slope sheets are fit to withstand such commodity and that hoppers and attachments are in first-class condition and entirely free from defects. All other equipment of the hopper or gondola type for general utility loading may be inspected on the ordinary interchange basis with the conditions more or less perfect, but not with the special inspection required for ore loading.

The foregoing conditions from a mechanical standpoint will furnish the transportation department the equipment so that with little or no trouble it can be utilized for any purpose intended or desired. But let us not forget that the equipment must be carefully repaired after it has been thoroughly inspected for light truck repairs and work that seems to be overlooked as a general rule. I have in mind our vol-

*From a paper presented before the Car Foremen's Association of Chicago.

ume of empty refrigerator cars that should be specially handled before the load is placed in the car. This work should include not only the upkeep of air brakes, but also the arch bars, wheels, bolsters, draft rigging and all carrying parts of the car. To bring about such results there should be a systematic method of handling the empty equipment, preferably by the owners, when the owners are the loaders, or in immediate touch by the trunk lines, so that no car when the load is placed in it will necessitate repair track movement under ordinary conditions until reaching its final destination with the load in question. To illustrate the point I am trying to bring out for the benefit of interchange, for the month of December, 1918, in the Niagara Frontier district, the records indicate that our inspectors were obliged to condemn loaded cars to the repair track to the extent of having 1,200 pairs of wheels changed on eastbound interchange, and 20 per cent of this number were on high class freight carrying fresh meat, stock, poultry and similar commodities. This is one item alone out of our daily work that demonstrates the absolute necessity of doing all the necessary work on the crippled car before the load is placed in it for movement, and this must be done to get the service through on our high class special loading that invariably makes express time service.

NECESSARY ACTION ON LOADED EQUIPMENT BEFORE LEAVING THE INITIAL POINT OF LOADING

There must of necessity be close co-operation between the car department employees and the employees who are placing the loads in the car, both at freight houses, industrial plants and all other similar loading points, to see that the Master Car Builders' rules are strictly observed, both on open and closed cars, to protect the lading enroute from shifting and otherwise, and also on double and triple loads, to see that they are carefully built up to insure safe movement in line with the Master Car Builders' loading rules. These rules as in effect are revised from year to year and are perfect to cover the interchange throughout the country if strictly adhered to and carried out. The non-carrying out of these rules causes damage to lading, accidents enroute and serious delay, which could all have been avoided had proper care and supervision originally carried out the intent and purpose of the Master Car Builders' Association. I would especially call attention to the necessity of providing proper doorway protection and blocking on the closed car to overcome damage to the lading and injury at the doorway enroute.

The greatest responsibility of the mechanical department for protecting the lading is, first of all, to have a perfect car to put the lading in, and, secondly, to see when the lading is placed in the car by the consignor, that it reaches its destination and the consignee in the condition that it should, thereby overcoming, unnecessary expenditures to bring it back to its original condition.

INTERCHANGE INSPECTION FOR PROTECTION OF EQUIPMENT THROUGHOUT THE COUNTRY

Granting that we have complied with all of the previous requirements, the car is accepted for train service to its destination, and should proceed without serious difficulty. Primarily interchange inspection was intended for the purpose of a monetary protection on defects occurring through what we term unfair service that did not impair the strength or serviceability of the car, together with penalty provisions for not observing the requirements of selection as mentioned above. With the suspension of such service and the adoption of government control methods, there would naturally seem to be little use for interchange inspection, but when taken collectively the zones of our railroad centers are so distributed that when the equipment reaches these intermediate terminals it has covered, approximately, from 150 to 300 miles, and the service demands an examination of the running gear, a re-examination and repair of all air brakes and care and attention to lubrication and packing, which in the Niagara Frontier district, as a rule, is handled in about five minutes to a car.

The inspectors on the string as it reaches the receiving yard are two ground men, one roof man and two following-up men, and where the interchange demands it, the same number starting from each end of the string, except the roof man. At this time we inspect and condemn all handling line defects under government requirements, repair all yard defects, such as nuts on box bolts, carry irons, column bolts, draft pan attachments, also brake connection bolts and cotters, brake shoes and keys, brake hangers and parts, and all connections of the hand brake attachments. In many cases we apply brake beams in the train yard, in order to overcome switching any car to the shop track unless absolutely necessary. The finish of the string is then taken for switching and advanced to the receiving line yard as a rule, where the air brake test, repair and oiling is covered. The disposition of through business under such arrangements is based on the interchange of 8,000 loads and 3,000 empties every twenty-four hours, with an average of one car out of ten as a cripple to the repair track. This shows why we plead for better equipment at the initial point of loading, to overcome serious delays that must be faced enroute if such action is not taken, and which is kept constantly before us by our transportation department.

At this time I wish particularly to dwell upon the enormous losses through accidents that have occurred in our immediate district, where the old saying, "a stitch in time," is applicable. In going over some claims with the claim department of one of our trunk lines I was astonished to learn that during the year 1918 that particular line paid out, in the claim department, $5,619,000 to cover loss from accident, leakages, theft, improper stowing of lading and kindred causes. If each man takes pride in his position and is zealous to do his work without any sting of conscience, let us apply this principle to our trains enroute and not be charged with negligence that causes untold misery and loss of large amounts of money. In other words, if responsibility is ours, let us shoulder it and share it. This can only be done by every individual doing his full share both in the pit and in a supervising capacity.

I would strongly recommend that in order to have co-operation and a common bond of personal responsibility, frequent get-together meetings be held, bringing up points of self-interest for all concerned, which would bring about most excellent results.

We should not have any matters connected with the service that those associated with us are not thoroughly conversant with. The important duties the employees of our rolling stock departments are obliged to perform, should be an incentive for each and every one of us to give the very best that is in us to the railroads of our great country.

DISCUSSION

The discussion brought out many circumstances which hamper the repairing of freight cars at the present time. Mention was made of unsatisfactory labor conditions still existing and insufficient forces due to the reductions in the hours of service. Failure to authorize expenditures for betterments has resulted in the setting aside of cars requiring heavy repairs. The speakers agreed that there is much trouble due to the reloading of cars which are not fit for service but no method has been found by which this abuse can be controlled on industry tracks.

Some improvement has recently been noted in the condition of air brakes, but the tendency to neglect cars needing heavy repairs is causing a steady decline in the general condition of the equipment and cars are now accepted in general service that would have been carded bad order at the first interchange point under the standards in force a few years ago.

SHOP PRACTICE

ENGINEHOUSE CRANES

BY E. A. M.

The following three types of cranes for use in enginehouses are in general use on one large road and have been found very serviceable and convenient.

POST CRANE

Fig. 1 shows a 2,000-lb. capacity post crane for roundhouses, which is generally located on the first post inside of outer wall of the house and is located on every post in that circle. In some cases possibly only a few located in some certain part of the house may be necessary, while in others it may seem most desirable on every other one. That is to be determined by local conditions and is, of course, optional with the user. The idea is to show a very good crane that has resulted in being a time saver for such work as lifting bumper castings, wooden bumper beams, front ends and doors, cylinder heads, steam chest lids, etc. By moving the 6-in. channels weighing 8 lb. per foot and 4 ft. 7¼ in. long. The castings (*A*) are placed between these upright channels at each end and have a circular base two inches in diameter, which extend into castings above and below, turning in them. These castings are bolted on the post with ¾-in. bolts, with plates on other side and nut locks are provided. Two ⅝-in. vertical bolts with lock nuts keep these castings a proper distance apart, or rather from spreading. Angles are used to secure the brace to the horizontal jib. The swinging axis is 10 in. in front of the post to give it greater range, in fact it has a range of about 284 deg.

In one of our roundhouses having 40 stalls, we have 39 of these, one on each post between the stalls, and nearly all are so provided, as a matter of fact all that are of any importance.

CRANE FOR LIFTING AIR PUMPS

A portable crane for lifting air pumps on or off engines is shown in Fig. 2. At times, when a locomotive comes into

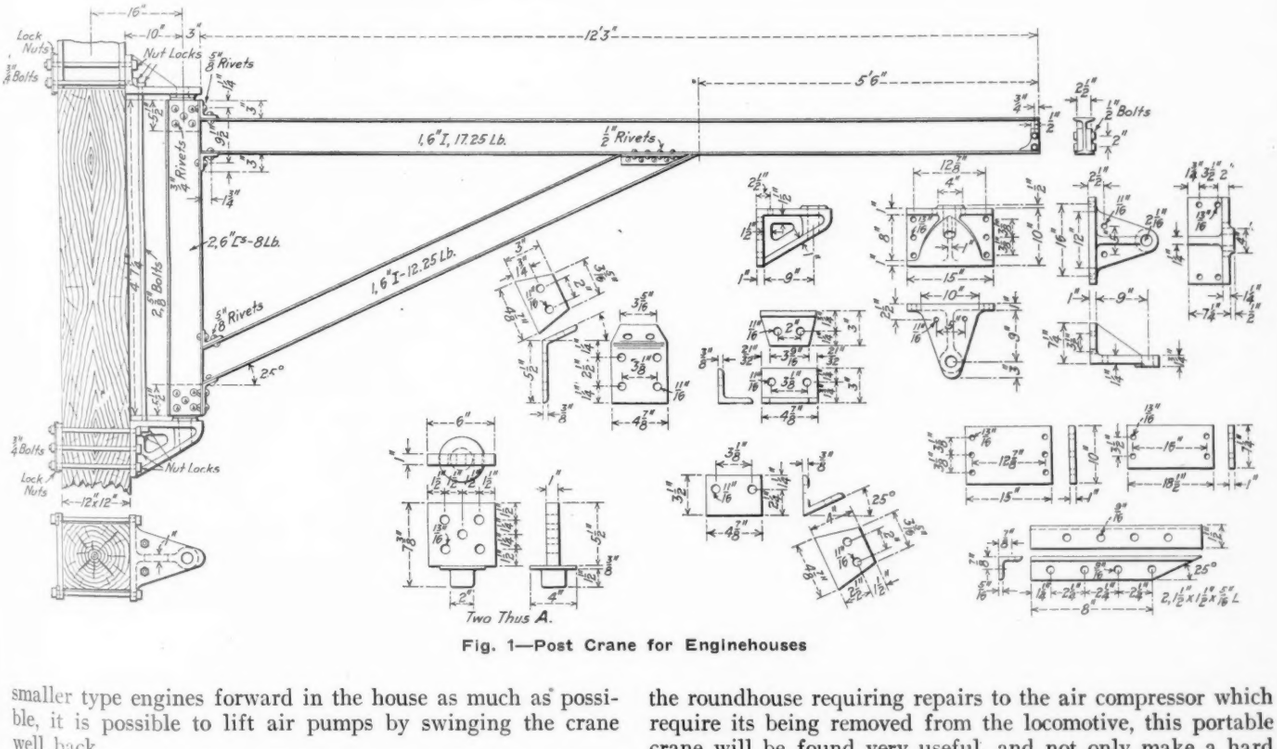


Fig. 1—Post Crane for Enginehouses

smaller type engines forward in the house as much as possible, it is possible to lift air pumps by swinging the crane well back.

This is equipped with a 2-ton differential chain hoist on a trolley which has a movement of nearly 5 ft. The top I-beam is 6 in., weighing 17¼ lb. per foot and is 12 ft. 3 in. long; at the end there is a small casting on each side to prevent the trolley from running off. The brace is a 6-in. I-beam weighing 12¼ lb. per foot and the vertical pieces to which these are fastened by angle plates (riveted) are two the roundhouse requiring repairs to the air compressor which require its being removed from the locomotive, this portable crane will be found very useful, and not only make a hard job easy but do the work with but a slight delay to the locomotive. The uprights are made of 2½-in. round iron pointed at the bottom for safety sake. These are amply braced by the ¼-in. by 1-in. pieces as shown. About 11 ft. 9 in. above the floor a weld is shown and the upper ends or pieces are welded to the 2½-in. uprights. These upper pieces are spaced ⅝ in. apart by the plate and washer,

leaving a 5/8-in. space in center for the projecting or supporting arm which is shown as detail *A*. The piece *B* is bolted to this. The ends of this piece are about one foot apart and these rest on the handrail of the engine for support. You will note that there is plenty of space for lifting the pump as the connecting piece is 3 ft. 4¼ in. center to center. A suitable hoist is, of course, attached to the eye *C*, which has a trolley wheel. While this apparatus must be rather heavy in order to adequafely support an air compressor, it can be easily handled by three or four men. The

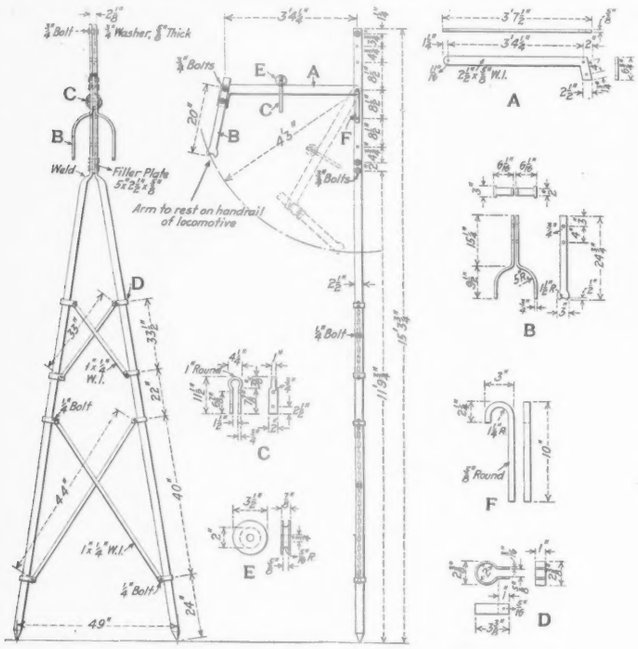


Fig. 2—Portable Crane for Mounting Air Compressors

swinging or supporting arm can be swung down to some extent, out of the road when not in use, as shown by the dotted lines.

STACK CRANE

Fig. 3 shows a locomotive stack crane which has been found very serviceable where other overhead or permanently

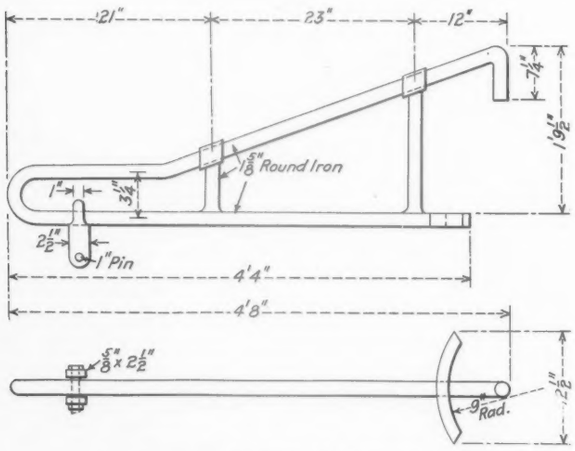


Fig. 3—Stack Crane for Locomotives

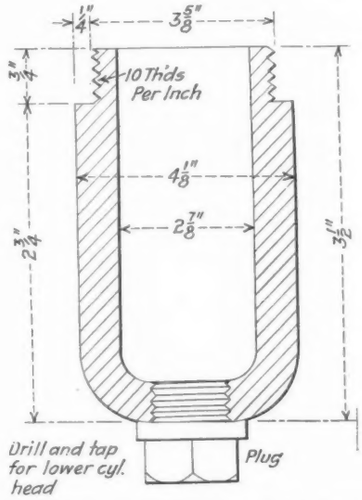
fixed cranes are not available. It is made up from 1⅝-in. bar stock, as indicated in the illustration, the upper arm of which is bent over at the end to fit over the top of the stack. The horizontal arm has a curved rest, bent to a 9-in. radius, which fits against the side of the stack. The upper and lower arms are reinforced by two ties, also made from 1⅝-in. iron, extended between them. The outer end of the frame supports an eye which carries a suitable chain hoist. This is free to move on the frame for a short distance, in order to get the proper location of the hoist. This is an excellent device for lifting heavy cylinder heads, steam chest lids, sections of cast iron bumper castings, wood bumpers, front ends, etc. Where other facilities are not provided it has been found very serviceable and will serve to materially shorten the length of time engines are kept in the roundhouse for repairs.

RECLAIMING LOWER HEAD OF CROSS-COMPOUND AIR COMPRESSORS

BY J. H. HAHN
Assistant Roundhouse Foreman, N. & W., Bluefield, W. Va.

One of the most common defects which develop in the 8½-in. cross-compound air compressors is a broken piston rod. When the high pressure air piston rod breaks or the nuts work off the lower end, the result is generally that the pocket in the lower piston head in which the end of the rod works, is broken out. Ordinarily this starts the cylinder head on the road to the scrap pile.

The fitting shown in the drawing was designed for use in reclaiming cylinder heads broken in this manner and a large number of them have been applied with excellent results at Bluefield. The broken heads are placed in a large



Forged Fitting Used to Repair Broken Lower Cylinder Heads of Cross Compound Air Pumps

gap lathe and bored out and threaded to receive the fitting, which is forged from a piece of wrought iron and threaded as shown in the drawing. A large Stillson wrench is used to put the fitting in place, and it is set up reasonably tight. Heads thus reclaimed have been found to be as good as new ones.

COMPLETE LOCOMOTIVES SHIPPED TO FRANCE.—The United States Army Transport Force has announced as one accomplishment under stress of war conditions the shipment to France of more than 400 American-built locomotives, weighing 73 tons each, completely assembled except for smokestack and tender and able to move under their own steam within a few hours after landing in France. The engines were shipped in special ships, each carrying 36 locomotives. About 1,200 other locomotives were shipped in sections easily assembled on the other side.

THE GAS WELDING OF THIN PLATES

Special Types of Joints Which May be Used, Some of Which Do Not Require Use of Welding Rods

BY J. F. SPRINGER*

I.

THE welding of plates not exceeding ¼ in. in thickness is an art in itself. Beveling, which is ordinarily so essential, is not always necessary or advantageous when welding thin plates, and with very thin sheets the highest temperatures are not desirable. But a shop using acetylene for general purposes may also find it advantageous to use the same equipment for thin work. The difficulty of uniting thin plates with an excessively hot flame lies largely in securing the necessary degree of rapidity and uniformity in the application of the heat. If the "hot spot" of the acetylene flame is advanced too slowly the edges of the work are apt to be melted away in places; if it is advanced too rapidly a good weld is not obtained. The operator must find the correct speed, taking into account the work in hand and the power of the torch. With thin work the necessary rate of advance will often be quite rapid, and it must be kept steadily at just the right rate. Furthermore, as the "hot spot" is not large, it becomes necessary that the torch be held at just the proper distance from the work.

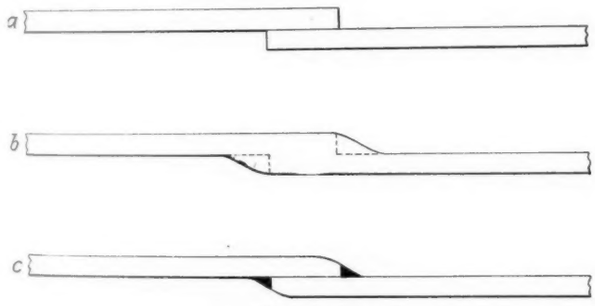
It may seem that soldering and brazing would be preferable to gas welding as a means of joining thin sheets, and this is sometimes the case. However, soft solders are usually weak solders, and hard solders which possess high strength are not always convenient to use. An objection which applies to all solders is that they differ in character from the metal of the work, which means that the electro-potentials differ, and that under certain conditions electrolysis is to be expected. Thus, in the case of the thin steel sheets used in passenger car roofs electrolysis is to be feared if the joints are sealed with a metal differing from that of the work. With gas welding, it is usual practice to use the same or nearly the same metal for the joint as is to be found in the sheets to be joined.

The heat for soldering operations, especially where hard soldering is to be done, is not always conveniently applied. Thus, the case of the roof sheets for passenger coaches might present difficulty. This welding is done not for strength of joint, but for water-tightness. The edges of the sheets come together on the double flange of a T-bar and are riveted in place. Then the welding operation is carried out to seal the joint. The workman gets up on the roof and applies his torch. To do this job by brazing would probably be difficult, if not impossible. There are, in fact, so many cases where the oxy-acetylene and the oxy-hydrogen welding appliances may be taken to the job, that this alone gives the process a considerable advantage over brazing.

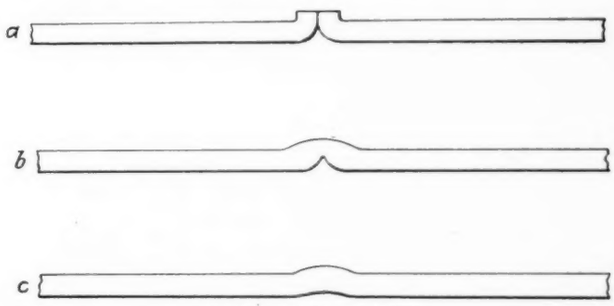
*Author of the handbook, "Oxy-Acetylene Torch Practice."

VARIETIES OF JOINTS

During the last 10 or 15 years, as gas welding has come more and more into commercial use, a variety of forms of joints suitable for thin plates have been developed. There are others which, although they have had no great test in actual practice, are worthy of consideration because of their conformity to requirements of the gas welding process. Some joints are good for one kind of service, but useless for another. Sometimes one joint is to be preferred to another not so much because it is a better joint, but because comparatively unskilled labor may be used in making it. Again, one style is preferable for certain jobs because it may be made accessible to the operator. In short, there are a variety of conditions surrounding individual jobs, all of which must be considered in the final choice of the type of joint to be used. But in all autogenous welding there is one rule which is quite generally applicable: Seek to locate joints away from corners. The object in removing the weld from a corner is to avoid the bending stresses to which corners are often subjected, but there may be exceptions even to this rule. In the case, for instance, of a tank with a bottom heavily dished inward, if the angle where the rim of the plate and the body of the cylindrical shell meet is sufficiently sharp, a weld where the edges come together may not be subject to appreciable bending stresses and such a joint may be permissible.



Plain Lap Joint



Modified Edison Joint

Plain Butt Joint.—The simplest joint is probably the one where the edges of the plates butt one against the other. The weld is made by melting the edges into each other and sometimes by the addition of new material. If the edges make a joint that is even and free from small cavities before heat is applied, there will be little use for a welding rod, unless it is proposed to pile up metal along the joint on one or both sides. However, where cavities exist, which will include the majority of cases, there will be more or less of a depression all along the line of the joint unless a welding rod is used to supply the extra metal needed. It may be added at the time the edges are melted together or put in place in a second operation.

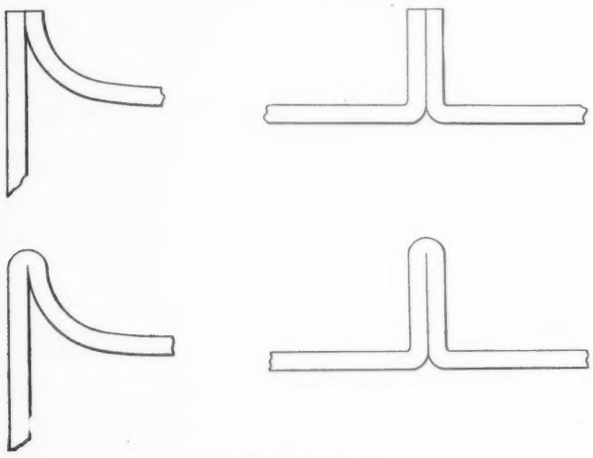
The plain butt joint may be welded from both sides. This

is often desirable and in some cases necessary. In welding from one side only it is necessary that the fusing temperature penetrate all the way through the full thickness of the plates to secure a perfect weld. Other things being equal, the difficulty of securing heat penetration will vary with the plate thickness.

It is possible to get welds without appreciable depressions, even though no rod is employed, by finishing the edges to make a close junction. The undesirability of a depression along the line of the weld depends on the service the work is to perform.

Beveled Lap Joint.—The edges of the two plates may be beveled and overlapped preparatory to the application of heat. The torch is to be operated preferably from both sides and the metal may be thickened by the use of a rod. If depressions are to be avoided when no rod is employed, the edges should fit closely to eliminate voids. If building up of the seam on both sides is carried out along the lines of the joint the two ridges of metal will not be directly opposite each other.

Beveled Edge Butt Joint.—In this joint the edges are brought up close together or even to contact. The rod is melted in to fill up the groove, and the groove is at the same time heated to the melting point. This particular joint is handled according to regulation methods used for general work, and the plates may be double beveled. The metal



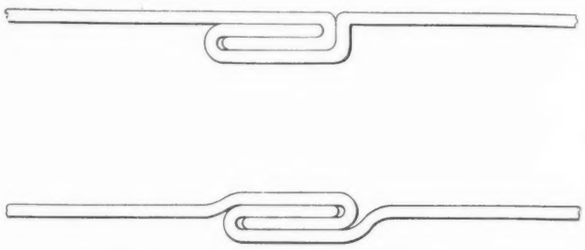
The Edison Joint

from the rod may be piled on one or both sides of the work. The groove, however, need not be as wide as in ordinary work.

Plain Lap Joint, Without Rod.—With thin sheets one may simply be lapped over the other and heat applied to produce a molten condition over the entire area of contact. The question of thickness controls only to the extent that the torch may be limited in getting its heat through far enough. When working with metals which respond to old-time smith shop welding methods, light blows of the hammer may be employed to encourage union over the area of contact. Steel and nickel are such metals. The plain overlap may be especially useful where the two sheets are not of the same thickness.

There are cases where it is not necessary to secure the strength obtainable by melting the contacting surfaces into each other. In such cases the free corners of the overlapping plates may be welded on each side of the work. Where this style of weld is satisfactory from the standpoint of strength it may be carried out through a considerable range of thicknesses. In the diagram showing this modified plain lap joint, the darkened regions show metal that has been melted off the free corners and filled in the adjacent angles. Where rivets are depended on for strength and welding for the seal, this is a useful type. As no rod is required, the workman has his left hand free.

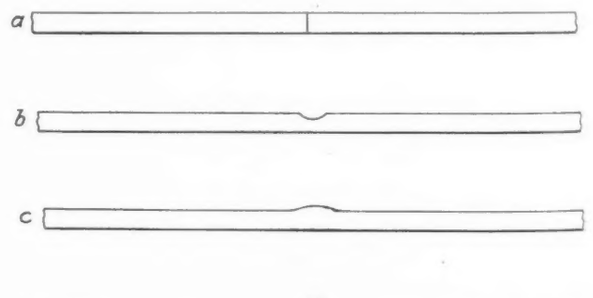
The Edison Joint.—In this type of joint the weld is made by melting together the edges of two plates lying alongside of each other. This joint secured its name from the fact that it was first used by the Edison Storage Battery Company in making storage battery cells. The metal in this case was thin nickel-plated steel, and the cell consisted of a rectangular shell with a single longitudinal seam and two heads of cup form let into the ends of the shell with their edges out.



Two Types of Folded Joints before Welding

The longitudinal seam was located on one side away from the corner.

This joint possesses a number of excellent features. It is easily prepared and easily welded, and as it requires no welding rod it permits the operator to have his left hand free. Considerable variation in the application of the heat is permissible, since there is a considerable margin in the amount of metal that may be brought into the weld. The effect of variations in the rate at which the torch is advanced and in the distance of the torch from the work will be evident only in irregularities in the profile of the finished joint which may be entirely satisfactory otherwise. The Edison joint is a good seam if the conditions of service do not produce stresses tending to open the joint on the unwelded side.



Plain Butt Joint, Showing the Effect of Welding Without or With Rod, and the Improved Butt Joint

Where such stresses are likely to occur the joint in its simplest form is not a suitable one.

Modifications of the Edison Joint.—Manifestly, it is not necessary that the bent-up portion of this joint be especially deep. In fact, the deeper it is the greater is the leverage tending to open the angle and break the weld. The bends may be reduced to a very slight depth, sufficient merely to supply metal easily reached by the torch. After the weld is completed it will, in such cases, show a protuberance on the operating side of the work and a groove or depression on the under side. The form of this depression depends on the sharpness of the bends and on the penetration of effective fusing heat. A groove in the shape of a narrow and deep indentation may for certain classes of service be objectionable as defining a line of breakage. The groove may be modified

by applying a welding heat on this side of the work and totally eliminated by using a welding rod. Where the welding rod is not used, the form of the joint may be further modified by the use of the hammer. This provides a method of securing the full thickness of metal at the joint without using a welding rod.

The Improved Butt Joint.—Welding without rod is advantageous in working on thin plates, because it releases the operator's left hand to assist in steadying the torch, and because the new metal may be otherwise provided in a manner insuring a uniform amount all along the seam. This latter point is at times important where uniformity of appearance is desirable. Thus, with the Edison joint, where the bent-up portions are shallow, they provide the new material in a way to meet this requirement. The same result may be secured by another method which may be easier to carry out under some conditions. The edges of the sheets are left square as if for a plain butt joint. But instead of putting them in contact with each other, a thin strip of metal is set between them. This strip is wide enough to extend slightly above the surface of the sheets. When the weld is made the strip is melted into the edges of the sheets and the whole region consolidated. The amount of new metal added depends upon the extent to which the inserted strip projects above the surface of the sheets.

A modification of this type of joint requires the strip to be set so as to project on both sides of the joint. There are then two heating operations.

The Folded Joint.—Where the plates are very thin and it is not difficult to provide for the penetration of a fusing heat through several thicknesses of the metal, a folded joint may be used. There are two principal forms. In one both sides of the work disclose an increase in thickness; in the other this shows on one side only, the other side remaining flush with the general surface. The illustrations show clearly the manner of folding for each of the forms. It should be noted that where the former type is permissible, both sheets are folded alike, thus simplifying the preparatory work. This style of weld requires a considerable degree of skill. First, the thinness of the sheets requires prompt and uniform action on the part of the welder. Second, enough heat has to be supplied to secure intermingling. The skill required may be reduced somewhat by applying the heat in two operations, first from one side and then from the other, and by using the hammer to assist the union. In any case, however, it is not a job for a beginner.

(*To be concluded.*)

RECLAIMING BUSHINGS FOR 9 1-2-IN. AIR PUMP REVERSING VALVES

BY J. H. HAHN
Assistant Roundhouse Foreman, N. & W. Bluefield, W. Va.

A set of tools has been developed at the Bluefield shops of the Norfolk & Western, by which it is possible to reclaim successfully the reversing valve bushings for Westinghouse 9½-in. air pumps.

By referring to the drawings, which show the details of the various tools, the method of using them may very readily be explained. It is first necessary to remove the dowel in the reversing valve bush. After this has been done the arbor *A*, Fig. 1, is then placed in position in the bushing. The washer *B* and nut *C* are then placed on the end of the arbor and the nut securely tightened. Next the reamer *D* is placed on the arbor, followed by bushing *E*. This bushing has two lugs on each end, which fit in the slots in the end of the reamer. The split driving nut *F* is then placed in position, on the threads of the arbor, inside of sleeve *G*. The wrench *H* is placed over the sleeve, the projection on the side of the latter fitting in the slot in the wrench, which is finally secured in place with a ⅜-in. set screw.

With this device the bushing is then reamed out to fit the next larger size of reversing valve, which, as shown on the drawing, Fig. 1, is 1 13/32 in. After this reamer has been driven to the bottom of the bush a 1 7/16-in. reamer is placed on the arbor and driven down about 1/16 in. below the first port in the reversing valve chamber bushing. This gives the valve the proper clearance and prevents it from wearing a shoulder in the bushing, as is usually the case.

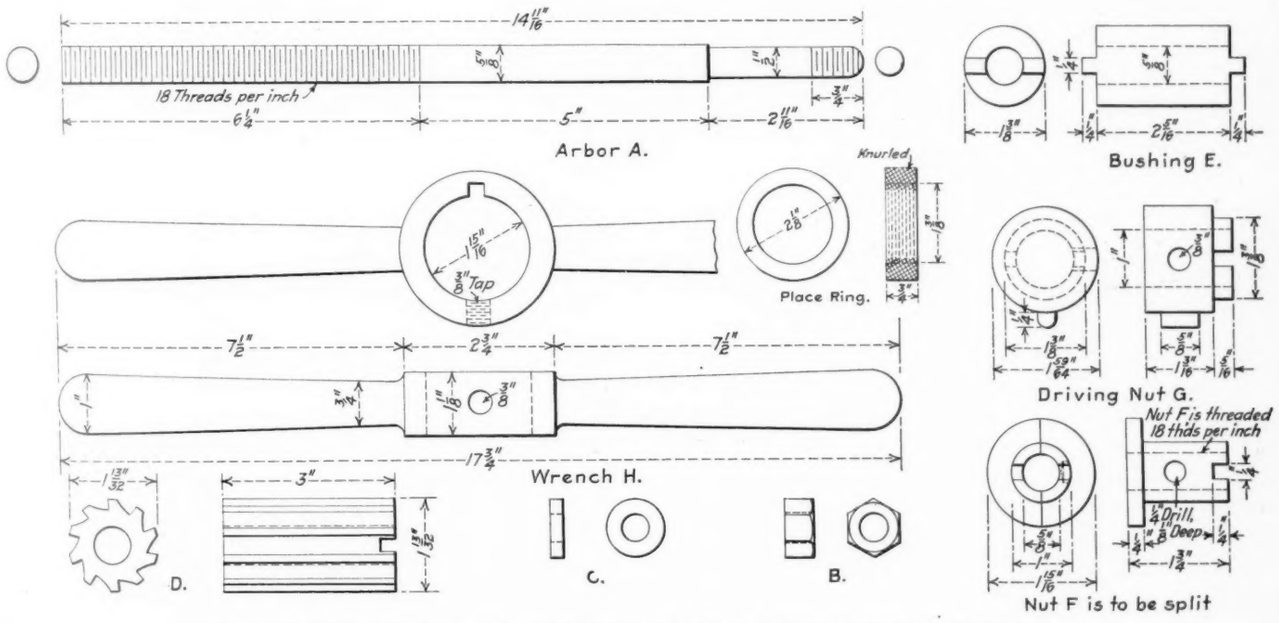


Fig. 1—Details of Special Tools for Reaming Out 9½-Inch Pump Reverse Valve Bushings

After the bushing has been reamed the dowel is replaced from the inside, using the tapered wedge shown in Fig. 2, or the special dowel replacing tool shown in Fig. 3.

The latter tool has a cylindrical body 1⅜ in. in diameter, which is made in two parts dovetailed together. Extending through the body longitudinally is a tapered hole in rectangular cross section, in the bottom of which is drilled a hole

to fit the 5/16-in. dowel. A plunger of the same size is placed in this hole from the inside and a tapered wedge driven between the plunger and the tapered side of the hole in the body of the tool. With the device in place inside the bushing it is thus possible to drive the dowel into place. The

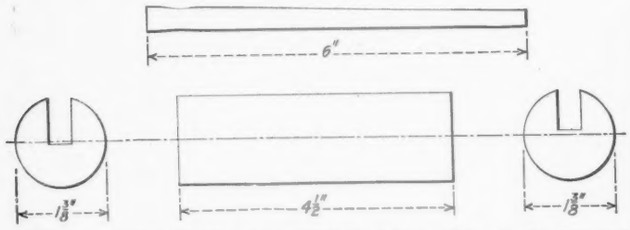


Fig. 2.—Simple Wedge for Replacing Dowel Pins in the Reamed Bushings

slot in the body of the tool permits it to be slid into place over the end of the dowel.

Special reamers of the shell type are used, which may be ordered from manufacturers or made in the shop. Aside from the reamers the tools shown in the drawing were all

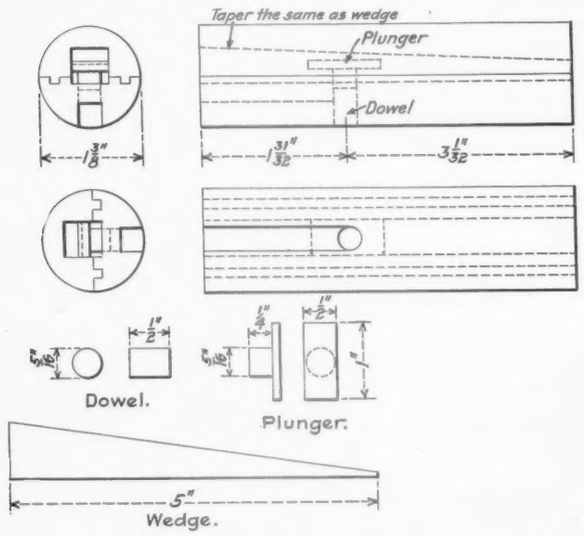


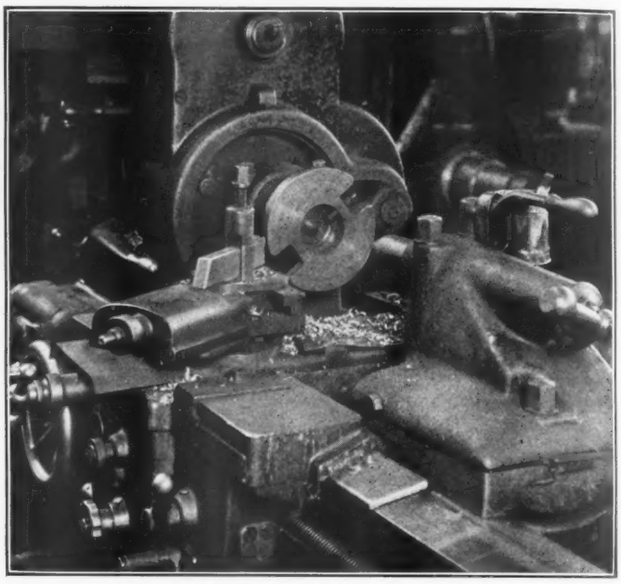
Fig. 3—Another Type of Dowel Pin Replacing Tool

made by apprentice machinists from scrap material. A discarded piston rod from an 8½-in. cross-compound pump furnished a good grade of steel for this work.

INCREASING PRODUCTION ON BOLT LATHES

In the illustrations shown below are shown two devices applied to a portable lathe in the Beech Grove shops of the Chicago, Cleveland, Cincinnati & St. Louis which will save time on any lathe used for turning bolts. The chuck shown is simple but nevertheless very effective. It screws on to the spindle and projects beyond the center with a recess to receive the head of the bolt. Extending into this recess is a set screw which can be tightened to grip the head of the bolt. In practice the screw is run up so that it just clears the flat on the head when the bolt is on the center. The bolt can then be inserted but cannot turn in the chuck. The flange of the chuck extends beyond the head of the set screw in order to keep it from the possibility of catching the clothing of the operator.

The indicator shown in the illustration of the tail stock is a great convenience for setting the center where one standard taper is used. The arm is L-shaped and is pivoted at the angle on a stud in the top of the tail stock. The short vertical arm bears against a stud in the base, the point of contact being at a point that causes the pointer to move about 18 times as much as the tail stock. This lathe is used



A Safe and Convenient Chuck for Bolts

only for cutting the standard bolt taper of 1/16 in. to the foot. The indicator is adjusted to show when the lathe is turning straight; then it is set to give the proper taper for a bolt 12 in. long, and these points are marked on the brass

Indicator on Tail Stocks for Setting to Turn Standard Taper

plate at the end of the indicator. The distance between the marks is then graduated to show the setting for bolts of any intermediate length. This attachment saves a great deal of time in setting the lathe and it has been found to be very much more convenient to use than the standard taper attachment.

How Joe Harris Saved His Job

It Was "Up to Him;" He Learned That Courage Is an Essential Quality of the Successful Foreman

BY A. J. TEN CATE

IT was Monday morning and although the 6:45 whistle had not yet sounded at McGregor shops, there was a gathering of unusual numbers around the shop bulletin board.

As each new-comer arrived he was instantly attracted by the crowd rapidly assuming large proportions in the center of the shop and naturally gravitated in that direction to ascertain the cause of the excitement. Sometime since Saturday afternoon a bulletin had been tacked on the board which read as follows:

TO ALL SHOP AND ROUND HOUSE EMPLOYEES

Mr. Joseph B. Harris is hereby appointed General Foreman at this point with jurisdiction over shops and round house.

Signed: H. L. Brownlee,
Master Mechanic.

Not that bulletins announcing the appointment of a new general foreman were of such rare occurrence as to cause wonder or even interest. The men in McGregor shops had long passed that stage. More general foremen had been appointed there during the past three years than at all other points on the road combined, and the new bulletin was the third notice of a similar nature in eighteen months. As each man who had held the job severed his connection with McGregor—invariably by request—the only comment heard around the shop was, "Who is the next victim?" and when that worthy put in an appearance it never caused even a ripple of excitement.

This morning, however, the usual order of things was reversed and an air of expectancy prevailed. Many and varied were the comments that came from the swelling crowd around the bulletin board. There were hoots and howls, cat calls, groans and much laughter. "Wait till old Hank sees it," said some one. "Hank'll explain what'll happen to him." This brought a yell of delight from the throng.

"Here's Hank now," shouted a man on the edge of the crowd, and all eyes were turned toward a tall, sinewy man possibly 55 years of age who, as he walked toward the crowd, wore an air of aggressiveness which indicated a determined and rather belligerent character.

Hank Hazard had been the rod shop foreman at McGregor for many years. A first-class mechanic and possessing marked executive ability, it was said of him by those who knew him best that had he been less aggressive in temperament he might easily have been a master mechanic many years ago. But Hank, while a good friend and with many traits of character that made for him a host of friends among the shop men, had the unfortunate habit of treating his superiors in a manner that always gained their dislike. Hank instinctively hated a new boss, and usually made it a point to let it be known. Yet he could be loyal, and when his support was once gained, as in the case of Mr. Brownlee, the master mechanic, who had been able to gain Hank's respect at the start, there was no task too big for him and his gang to undertake. It was claimed by many that when Mr. Brownlee was appointed master mechanic he owed his promotion from general foreman to Hank Hazard more than to his own efforts.

Hank wielded a powerful influence in the shop, and new general foremen usually tried to "get something on him" in order to fire him rather than to turn his influence to their own advantage. Perhaps it was natural that his regard for officials in general, and general foremen in particular, grew less and less as time went on, and his attitude toward a new foreman was always awaited with eagerness by the men.

So it was on this morning, and everybody expected some especially vitriolic remarks owing to the fact that the appointee was the last man any one in McGregor had expected to see in the position.

As Hank arrived the crowd made way for him so that he could read the bulletin. "What's up?" he asked, curtly, as he set down his dinner pail and adjusted a pair of steel-rimmed spectacles preparatory to reading the notice. A strange hush now pervaded the place where but a moment before so much excitement reigned. The crowd waited expectantly for an outburst.

"What's that?" said Hank, as he read the name, "Mr. Joseph B. Harris. Where did *he* blow in from?"

Not a man answered. They had expected Hank to catch on immediately, but apparently he had utterly failed to grasp the significance of the bulletin.

At last someone ventured, "Don't you know him, Hank?"

Realizing that somehow he had missed the import of the notice, which the boys seemed to understand, he read it again, this time more deliberately. Suddenly the truth flashed upon him and he turned abruptly to the men, with a flush on his face.

"Do you fellows mean to tell me that Mr. Joseph B. Harris is Joe Harris—our Joe?"

"Sure, Hank, that's who it is, all right."

"Well, if it is," said Hank, "it means another dead cock in the pit," and, picking up his pail, he started for the rod shop amid a roar of laughter as the 7 o'clock whistle blew and the men dispersed to begin work.

Old Ned Hanlon, the chief clerk, was busily engaged in sorting the night's accumulation of messages in the general foreman's office. As he finished his task he handed them over to a tall, broad-shouldered young man who was waiting for them. "There you are, Joe—I mean Mr. Harris," said Ned, half apologetically, as he handed over the last message.

Ned's attempt at being respectful was not lost on the new general foreman, who understood perfectly what was passing in his mind. Instinctively he knew what was passing in the minds of everybody in McGregor shops that morning, and as he turned to leave the office he felt his courage rapidly vanishing, and he began to wish he had refused the promotion Mr. Brownlee had persuaded him to take.

The ordeal was a hard one for Joe Harris. Born and brought up in McGregor, he was known by every kid in town as just a big, good-hearted, overgrown boy, bubbling over with good nature, always ready to help anybody, and everybody's good fellow. Not an enemy in the world, for who could dislike such a personality?

And Joe was a mechanic. There was no doubt of his ability in that line. When it came to understanding the locomotive and shop work, he outranked them all. He had served his time in McGregor shops, and long before he had completed his full apprenticeship he was regarded as a genius from a mechanical standpoint. His capacity for knowledge was extraordinary, and he easily led his classes in every department.

No sooner was he out of his time than he was placed in charge of the valve gang in the roundhouse, and his fame as a valve setter soon spread on the three divisions centering

in McGregor. His unusual mechanical ability, together with his good nature, quickly made him the most popular man in the terminal. His knowledge of the work in every other department was remarkable, while he knew more about what was in the storehouse and the different classes of material than the division storekeeper himself.

But Joe was no man to handle men. Everybody's good fellow makes a poor boss, and he was no exception to the rule. There wasn't a day he didn't do twice the work of any of his men. Young, strong as an ox, he seldom asked a man to do what he could do himself and, as is usual in such cases, many imposed on his good nature.

However, it was not long before Joe was placed in charge of the valve work in the back shop, and he was holding this job when he was appointed general foreman. When he was first offered the place Joe promptly refused it. To take charge of McGregor shops, full of old men, many of whom he had served under, looked too big for him. Then, too, he knew to be successful as a general foreman at that point meant a man capable of using the iron hand frequently, for discipline was a thing long unknown in McGregor.

Time was, Joe remembered it, when every man took pride in his work. Gang vied with gang in good-natured rivalry in swelling the output. Those were the days when 25 to 30 engines per month was a normal output.

But those days were gone. The loyalty for which the shop was noted was a matter of history, now almost forgotten. Many general foremen had come and gone during those years. Some had "finished quick," as old Hank Hazard put it when speaking on the subject, which was always a bitter one for him. Most of them were unfitted for such a position, and the men were never long in finding it out. It all had a demoralizing effect on the personnel. Discipline, interest in the work and loyalty, the three great shop essentials, disappeared. Output dwindled and costs soared. Mr. Brownlee, long noted for his organizing ability, came in for much censure from the management, and the superintendent of motive power came to McGregor frequently because of the poor showing at that point.

Naturally, McGregor shops had long since gained an unenviable reputation. Things went from bad to worse and finally came to a climax when in desperation the superintendent of motive power sent a new man to McGregor as general foreman, who started in by firing some of the best men in the shop. This gained for him the enmity of every man in the organization, a feeling which was increased as it became known that his experience was limited to a year or two on special work after serving a special apprenticeship on another road. He had never even had charge of a shop gang prior to his advent at McGregor as general foreman, and had secured the position through the influence of a friend of the superintendent of motive power.

At the time this man came on the job the road was doing a very heavy business. Power was required as fast as it came in, and any slowing up in engine despatching promptly blocked McGregor yard. At such times co-operation must exist throughout all departments, and the lack of it soon developed a crisis at McGregor so acute that the general manager went there to investigate.

The new general foreman, unmoved by the fact that things were tied up, and not knowing the general manager was on his way to the shop, was sitting in his office smoking a cigarette and reading a newspaper. As the general manager entered the door the young man presented a picture of indolent ease. Not dreaming the identity of the general manager he simply bestowed a "well, what do you want" sort of stare on that official, who sized him up as a clerk and asked, "Where is the master mechanic?"

"I have no idea," replied the general foreman, as he flicked the ash from his cigarette.

"Well, you look it," said the exasperated official, and he turned to go out just as Ned Hanlon entered the door. Ned was recognized by the general manager, who asked him where the master mechanic or general foreman could be found.

"Why, this gentleman is the general foreman," Ned replied, pointing to that worthy.

The general manager immediately turned to him and said: "If you have been running the power here I don't wonder we are tied up. I think we can dispense with your services."

When this occurred it was generally understood that Mr. Brownlee had been given one more chance to straighten out McGregor, and it was at this time that he sent for Joe Harris.

At first Joe refused to consider the offer, but Mr. Brownlee was insistent. He told Joe what his refusal meant to him personally, for it was up to him to put a man in charge whom he could trust, and Joe was about the only man fitted for the position who answered that requirement. It meant a big future for Joe, too, if he made good, and there was no reason why he could not do so. He reminded Joe of his mother and family, who relied on him for support, and this helped to persuade Joe to accept, for his expenses had always been so great that he had been unable to save anything.

As Joe walked into the shop this Monday morning he recalled all this and keenly regretted his decision. He suddenly saw the colossal nature of the task before him. Scarcely a man was at work; his appearance was a signal for what few who were busy to stop their work and exchange views with each other. That the place was demoralized he had known for a long time, but somehow he had never thought it was as bad as he now saw it to be.

Some of the men that first day showed a desire to respect him, at least in his presence. Some were openly defiant, while others ignored him altogether. Joe Harris as a workman was all right, but as a general foreman—why, he was nothing but a joke. The idea of taking orders from him was, to most of the rank and file, ridiculous. Many of the old men resented his appointment, and did not take the pains to conceal their feelings. And so Joe started in with his former friends and associates for the most part arrayed against him.

As was usual with him Joe did not spare himself, and was soon a slave to the job. Mr. Brownlee frequently warned him of his mistakes in this line, but in spite of all the advice given him Joe plodded on. He knew instinctively he was losing headway, that things were getting worse every day. He had never dismissed a man, nor had he censured a foreman. In his good-natured, whole-hearted way he had reasoned that his former friends would rally around him when they found that he was just the same old Joe. But he erred sadly in this respect, as many men have done before him.

Mr. Brownlee finally lost patience with him and often criticised him bitterly.

It was the 20th of the month, and the prospects for shop output were dark. Engines on the road were constantly falling down, and so many men had to be sent to the roundhouse to keep power repaired temporarily, that output was lost sight of entirely in the shop. Never had so much overtime been paid, and conditions generally were the worst in the history of the shop.

About 3 o'clock Mr. Brownlee sent for Joe after a long-distance 'phone conversation with the superintendent of motive power. As Joe entered the office that afternoon Mr. Brownlee arose from his desk and said to him: "Mr. Harris, I have called you here to tell you that my resignation is expected the first of the month if things don't improve. It is safe to say they won't improve, and you are the cause of it all. You could hardly have done more to hurt me if you had tried. Mr. Harris, you are a coward."

Joe stood speechless before his accuser. The words burned into his soul.

"A coward," went on Mr. Brownlee, "is a man afraid to do his duty, and that is exactly what you have failed to do, because you were afraid of your men. Instead of making

men respect you, and the position you hold, you have simply done the work, what little there has been done, and your men have stood around and had a good time. The best equipped man for the job on the system, you have proved to be the worst selection that has ever been made."

Joe knew he was hearing the truth; he realized he had failed, and for the first time he understood what it meant to the man who had tried to be his friend. As he rapidly called to mind the attitude of his men, their indifference, their utter disregard of instructions and their disloyalty, his blood boiled within him.

Suddenly turning to Mr. Brownlee, a new light shining in his eyes, he said huskily, "Is it too late? I want just one week more."

Mr. Brownlee noted with surprise his changed appearance. "All right," he said, "I'll give you one week more."

As Joe turned to leave the office he paused at the door, and then suddenly faced his chief. "Sir," he said, "one week is enough. If I don't get a move on things before that time, I, too, am ready to leave," and with this remark he left the office.

As he passed out to the shop he met one of his erecting foremen who asked Joe to accompany him to an engine in the roundhouse where he had some men making repairs which were giving them some trouble. Joe scarcely heard what the man said to him so deeply absorbed in thought was he, until he arrived at the engine. He then became aware of the presence of some men under the engine, whose conversation brought him to himself with a jolt.

"Well, Jack," said a voice, "we've been here now an hour and h'aint done anything but smoke cigarettes. Now they are all gone I am going home," were the first words Joe caught.

Laying his hand firmly on the arm of the foreman, who was about to call out to the men, Joe enjoined silence.

"All right," answered the second voice, "I'm with you, old-timer; gets tiresome hanging around in a pit waiting for the whistle. Some dump," went on the voice, "and always will be until they get a general who is one."

"Why, say, Jack," said the first speaker, "our gang h'aint done a day's work this month, and overtime! why, even I am ashamed to take the money, and you know I ain't no saint."

Joe fairly quivered. "Call them out," he said to the astonished foreman, who had never seen Joe Harris look like that before.

As the men crawled out from under the engine Joe recognized one of them as a man he had befriended only a short time before.

"A fair return you have made to me," he said, "but at least you have given me the opportunity I am looking for. Mr. Leslie," he said, turning to the foreman, "you heard what they said; you probably know it is true. You will not only dispense with their services, but you will see to it that their service record shows 'dismissed' and not 'resigned,' as has been done in the past; for they're fired." With this remark Joe started for his office.

A few moments later old Ned Hanlon, with an air of suppressed excitement, went through the shop and personally notified every foreman in McGregor to attend an important staff meeting at 5 o'clock that afternoon. No excuse would be accepted, Ned whispered he had been instructed to say, for failure on the part of any foreman to attend. The dismissal of the two men, quickly followed by a hurry-up call for a staff meeting, caused a sensation in the shop. The fact that Joe Harris had fired anybody, in itself was enough to start speculation.

"Something doing," was the unanimous verdict, and everybody was on edge.

Promptly at 5 o'clock the foremen filed into the large staff room over the office, where Joe, with cheeks flushed, was sitting at a table looking over some papers, while at his left was a stenographer from the master mechanic's office.

As he called the meeting to order, Joe noted that every foreman was present. "Gentlemen," he said, "I want you to listen to some letters." The stenographer then read some letters from the superintendent of motive power, two of which cited figures to show that McGregor shop was in worse condition than ever before. Joe waited impatiently, it seemed to the men, until the last letter was read, which concluded with "the conditions now obtaining at McGregor shops are a disgrace to this department and must not continue. Please advise at once what you purpose doing to effect improvement." Apparently this was what Joe had been waiting for.

"Gentlemen," he said as the letter was concluded, "I have advised Mr. Brownlee to answer that letter by saying that an immediate improvement may be looked for, and it is my intention to make good that promise. In the two months I have held this position I have tried to work with you all, hoping and believing that I might succeed in getting your co-operation. I reasoned that I had a right to expect it, but you failed to see it in that light. My attempts at bringing about an improvement have not only failed, but, as the records show, we have steadily grown worse, and at the present time we are far below the percentage we were making when I took the job. Every order I have issued has been a signal for even greater violations of the particular condition the order was designed to remedy. Overtime has doubled, although I have repeatedly called your attention to the necessity of reducing it. Repairs are made in a superficial manner, and men are allowed to do as they please. I have regarded you all as personal friends; you have treated me as an enemy. My predecessor was cordially hated by you all, and no effort was made to co-operate with him, yet his record is far ahead of mine. The last month he was here there were 15 general repairs turned out of the shop; if we get 13 this month it will be a surprise to me. Such, gentlemen, are the conditions which I have agreed to remedy."

As Joe faced his foremen there was an air of calm defiance about him no man had ever seen before. Joe Harris, the good-natured boy, had somehow disappeared. Joseph Harris, the man, a real general foreman who knew the game, stood before them.

"Gentlemen," he went on, "from this hour the slogan is 'Get Busy.' Each of you will have a copy of some instructions, on your arrival tomorrow morning, that mean business. I shall see that they are carried out. Engine failures and overtime will be reduced and output increased from now on. In conclusion, if there is a foreman present who does not want to start tomorrow morning with a firm and honest desire to work with that end in view and carry out instructions, I hereby ask him or them to resign here, tonight. Tomorrow will be too late."

Every eye in the room was fastened on Joe as he waited a moment before proceeding. "Very well," he said, "before we close, has anyone anything to say?"

Instantly Hank Hazard was on his feet. "Mr. Harris," he said, looking at Joe with an expression on his face no one ever remembered seeing before, "I want to take this opportunity to say that I for one am heartily ashamed of my record during your term of office, and I am likewise ashamed of the record of the shop and every man in it. We all needed just what you have handed to us, and I don't believe there is a man here who won't give you his hand and promise results from now on, and just to put it to the test I am going to take the lead," and Hank walked up to Joe and extended his hand. Every man in the room fell into line behind him, and each gave Joe a hand clasp that was genuine.

An air of unusual bustle and activity prevailed in the shop long before the whistle blew at 7 o'clock the following

morning. Most of the foremen had congregated early in the rod shop where Hank was busily engaged figuring out some calculations on the back of a blue print. "It's got to be done, boys," said Hank when they separated as the whistle stopped blowing, "don't fail."

As Joe Harris passed through the shop next morning he was quick to note a great change that had already been made. Every man was at work, every foreman on the job. That afternoon he met Mr. Brownlee, who simply held out his hand and said, "At last, Joe, at last; I knew it was in you."

Never was the slogan, "Get Busy," so faithfully carried out. Partly finished engines lying in the shop and not included in the schedule for that month began to take definite shape and were added to the schedule. In the roundhouse when engines were held for boiler wash, the rods, motion work and wedges were thoroughly gone over, and engine failures soon began to decline. Overtime in all departments was cut in half the first week. When the last of the month arrived there had been 16 engines turned out of the shop with a general overhauling, but Hank Hazard kicked because it wasn't 18, the number he had figured on.

Joe held frequent staff meetings, and every foreman was asked for ideas. These meetings brought immediate and profitable results. Every man in the shop took a personal interest in production. From the worst managed and most expensive shop, McGregor was soon looked upon as the best handled point on the system. From 15 engines a month, the output grew to 20 general repairs turned out regularly. Engine failures had practically been eliminated. How it was all brought about was a mystery to the management.

One day the superintendent of motive power came to McGregor and, after a talk with Mr. Brownlee, sent for Joe.

"Mr. Harris," said he, "there is a vacancy for a master mechanic on the Eastern division, and I want you for the place. Your record here the past three months, which, I will say, is unparalleled in my experience, justifies me in offering you the position. Bad as you are needed here it is only simple justice to recognize what you have done. My only concern now is, who will be your successor. Can you suggest a man?"

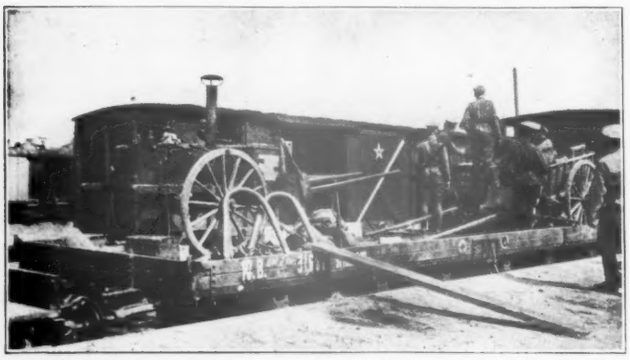
"I can," replied Joe, looking the superintendent of motive power squarely in the eye, "and a man who will continue getting the same results, if not better, than we are now getting."

"Does he work here, Mr. Harris? If he does, by all means, Mr. Brownlee," turning to the master mechanic, "let us give him the place. Do I know him?" he asked, again turning to Joe.

"Yes, sir," was the reply; "you have known him many years."

"Why, who can he be?"

"His name is Henry Hazard," said Joe.



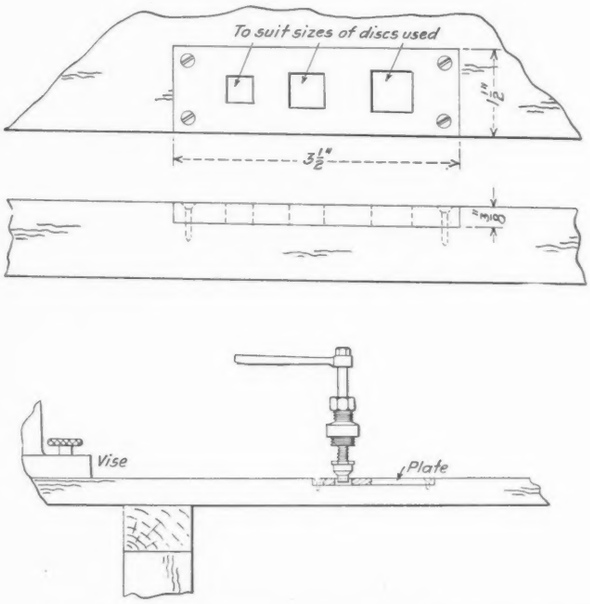
Railroading in Siberia

A CONVENIENT FITTING FOR THE INJECTOR REPAIR BENCH

BY F. W. B.

A very simple and convenient facility for the injector repair bench may be made by inserting a 3/8-in. steel plate, through which a number of square holes of suitable sizes have been cut, in the top surface at the edge of the bench. For the greatest convenience the plate should not be located far from the vise.

Where the injectors are fitted with valves of the disk type,



Bench Chuck for Removing Injector Disc Valve Nuts

the disks of which are held in place by nuts, it would ordinarily be necessary to place the nut in the vise when removing it, or when tightening it after the disk had been replaced. This is an awkward operation which in nearly every case can be dispensed with by the use of this simple device. All that is necessary to remove or tighten the nut is to drop it into the hole of the right size in the steel plate and the nut is thus held while the valve stem is unscrewed or tightened, as the case may be. Only occasionally will nuts be found so tight that the vise must be used.

GRINDERS FOR SUPERHEATER UNIT JOINTS

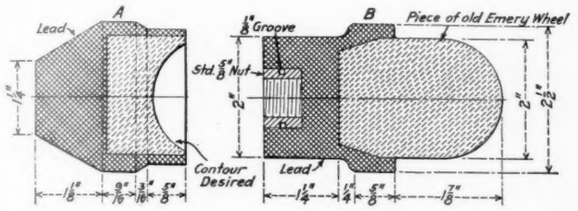
BY H. P. MAUER

The drawing shows a set of shop-made grinders for superheater unit joints which are made from pieces of old emery wheel imbedded in lead or babbitt. The concave grinder is designed to fit the chuck which is in universal use for this work, while the convex grinder is provided with a 5/8-in. nut in which may be screwed shanks to fit any machine that may be used to drive the grinder. The grinders are made by placing suitable pieces of broken emery wheel in a suitable mold and then pouring the lead or babbitt around them.

In the case of the concave grinder the chuck fit is machined after the body has been cast, and after the grinder has been clamped in the chuck the contour of the grinding surface is finished with an ordinary emery wheel cutter. In casting the body of the convex grinder a standard 5/8-in. nut, around the body of which a groove has been cut, is

placed in the mold to form the means of attachment for the driving shank. As in the case of the concave grinder, after the body has been cast the grinding contour of the emery stone is finished by the use of an ordinary emery wheel truing tool.

These tools were developed by A. Jiminez, roundhouse foreman of the Cuba Railroad at Camaguey, Cuba, and the tools have been in successful use at this point for five

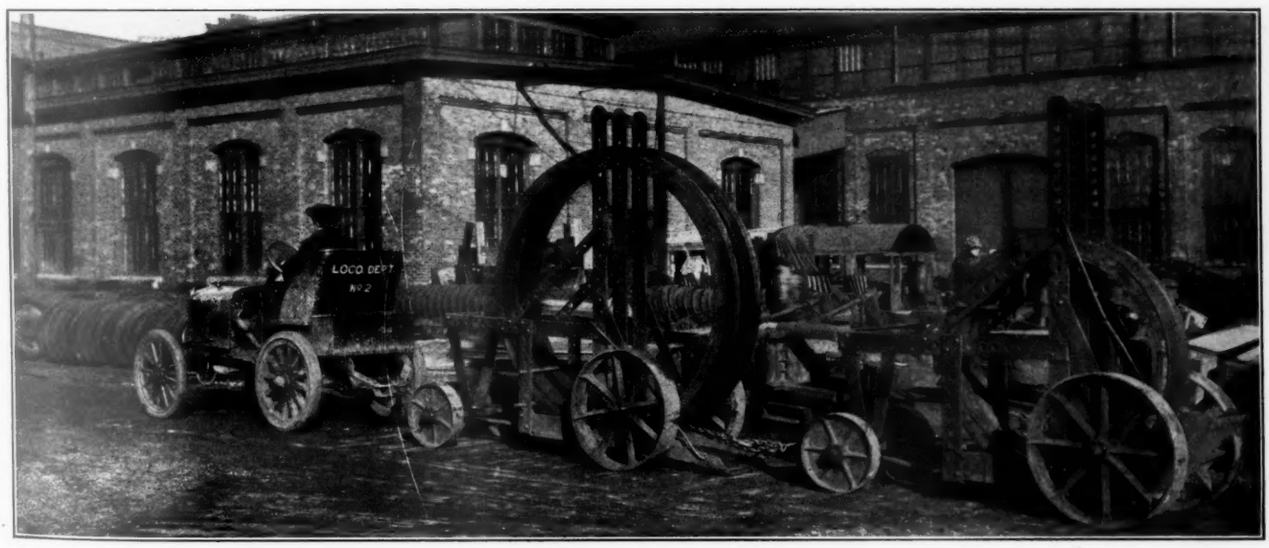


Shop Made Grinders for the Ball Joints of Superheater Units

months with excellent results. A set of superheater units can be ground with these tools in about one-third of the time ordinarily required with the regular grinders using oil and emery.

TRUCKS FOR HANDLING DRIVING WHEEL TIRES

Locomotive tires, particularly of the larger sizes, are difficult to handle unless an overhead crane or a large truck can be used. It is often necessary to transport tires from one shop to another where neither of the methods mentioned are practicable, and in such cases a considerable number of men are often used and a large amount of time consumed in the operation.

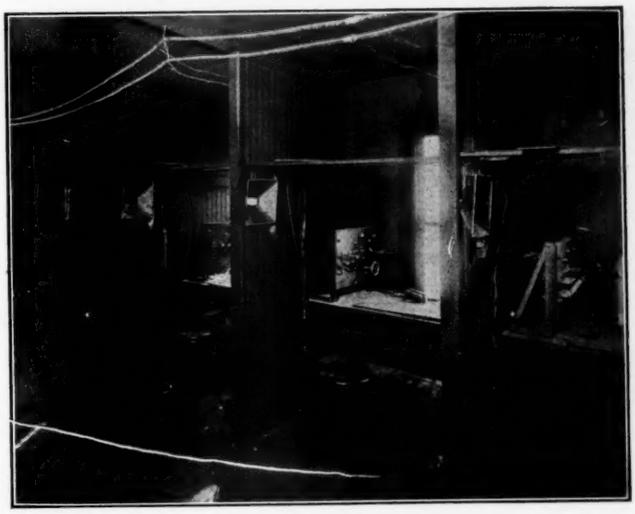


A Unique Truck for Transporting Tires

In the photograph which is reproduced above is shown a novel form of truck used in the shop of the Michigan Central at Jackson, Mich., to eliminate this waste of labor. The truck is constructed largely of second-hand material. The frame carries three uprights for holding the tires in position and the rear portion of the floor is hinged so that it can be dropped to form an incline up which the tires are run. When the tires are in place in the truck they are secured by bars placed through holes in the frame. The work of transporting a set of tires from one shop to another formerly required six hours with eight men on the work. With these trucks hauled by a remodeled Ford, the same job is handled by four men in one hour's time.

AN INSTRUCTION SCHOOL FOR ELECTRIC WELDERS

During the development of the extensive shipbuilding program of the Emergency Fleet Corporation the pressing



A Section of the School Equipment for Training Arc Welders

need for electric welders led the corporation to establish several schools for the training of electric arc weld operators. The purpose of the school was to enable men with no previous welding experience to learn the fundamentals of the art in the shortest possible time.

One of these schools was conducted under the supervision of the Lincoln Electric Company, Cleveland, Ohio. Now that the war is over this school has been released by the Emergency Fleet Corporation, and the Lincoln Electric Company is continuing it, putting its service at the disposal of any concern that desires to teach its men the art of arc welding. These men may come to the school and be instructed in any phase of the operation by thoroughly com-

petent instructors. A general idea of the equipment employed for practical instruction work is conveyed by the photograph showing one section of the school with individual operating sets and switchboards for each operator's use.

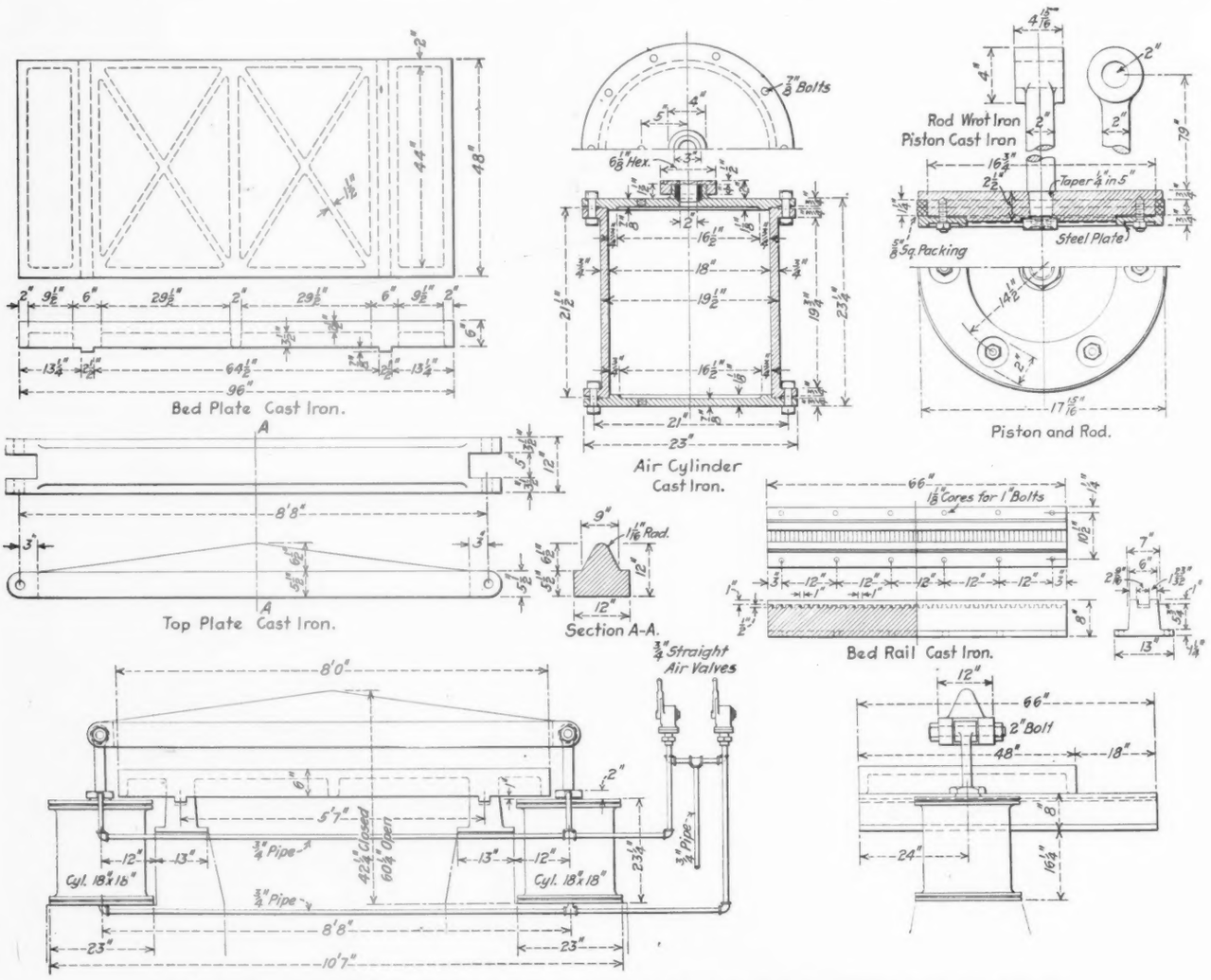
STRAIGHTENING AND FLANGING CLAMP

BY J. V. HENRY

The pneumatically operated clamp shown in the drawing is especially adapted to straightening and flanging work in connection with steel car repairs. The cast iron bed plate is 8 ft. long by 4 ft. wide, the length being sufficient to permit the straightening of the largest plates ordinarily used in steel car construction. By providing suitable blocks, larger sizes of various structural shapes may also be handled in the clamp.

The clamp is operated by two 18-in. by 18-in. air cylinders, one at either end. Two ¾-in. straight air valves are used to control the operation of the clamp, one for the admission and exhaust of air above the pistons and the other for the admission and exhaust of air below the pistons of both cylinders. The piston heads are of the solid type with a tapered fit on the rod. They are designed to take two rings of ⅝-in. square fibre packing, which are held in place by a steel follower ring.

It will be noticed that the tops of the bed rails are notched at the bottom of the grooves in which fit the tongues on the under side of the bed plate. This permits the bed plate to be moved backward or forward by means of crow bars, so that it may be used not only for straightening bent or distorted material, but also as a clamp for holding sheets in flanging operations.



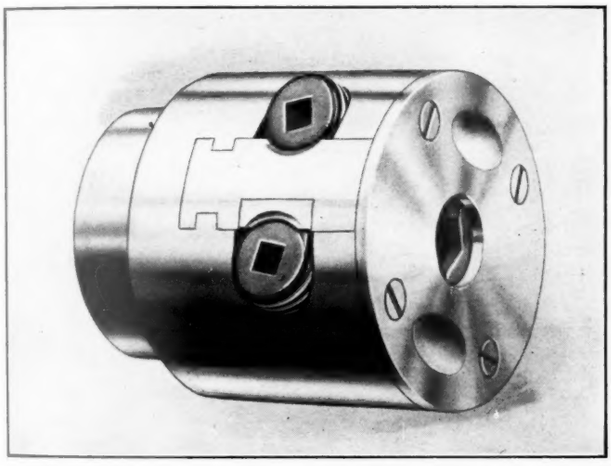
Pneumatically Operated Clamp with Movable Table, for Flanging or Straightening Steel Car Material

STELLITE.—This is an alloy of semi-rare metals, but contains no iron and therefore cannot properly be termed steel. The binary alloy, consisting essentially of cobalt and chromium, can be forged with difficulty at a bright red heat, but when it becomes cool its hardness remains as great as before the first heating. According to an article in the Iron Age, by E. Haynes, Stellite does not get harder as it gets hotter, but it gets tougher and holds the cutting edge longer. Cobalt is not affected by heat up to about 1,900 deg. F., and the tungsten and chromium are not affected by any heat up to 2,600 or 2,800 deg. F. It is clear, therefore, that the cobalt becomes tougher up to the degree of softening, but at the same time the other two metals are not changed. This makes a closer and tougher bond, allays all chance of crumbling, and makes the tool last longer for the reason that it has the necessary strength to take off a heavy cut without breaking.

NEW DEVICES

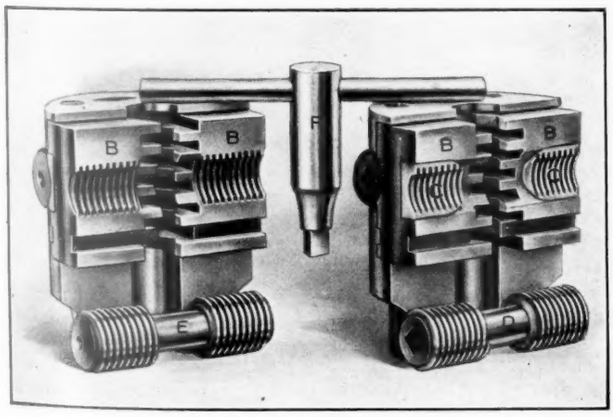
TWIN SCREW DRILL CHUCK

In the photographs are shown a twin screw drill chuck which has recently been placed on the market by the Marvin & Casler Company, Canastota, N. Y. The special features of this device are the twin screw clamping arrangement, and the rugged character of the construction throughout, the purpose being to provide for gripping the drill so firmly that it may be crowded to the limit of its strength.



The Casler Twin Screw Drill Chuck

Referring to the two views of the partially dissembled chuck it will be observed that the primary screw *E* is threaded directly in the chucking jaws *BB*, while the secondary screw *D* is threaded in floating nuts *CC*. When using the chuck the primary screw *E* is first operated to grip the drill shank between the jaws. After this screw has been set up, the secondary screw *D* is operated to bring the floating nuts *CC* against the ends of the pockets in the jaws, resulting in a grip equal to twice that obtainable by a single screw.

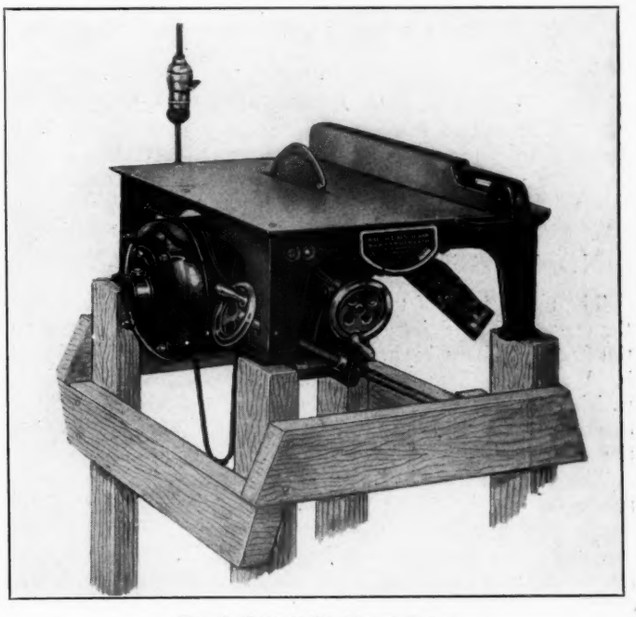


Details of the Drill Chuck

The body of the chuck is of close grained cast iron, while the jaws and screws are of high carbon steel, tempered. It is claimed that the combination of cast iron and steel tends to prolong the life of the wearing surfaces between the body, jaws and screws. The body is reinforced by a steel cap plate which prevents it from spreading when under strain, and the device has been designed to avoid any projections likely to catch the work or injure the workman.

BENCH SAW FOR WOODWORKING SHOPS

A recent addition to the line of bench machines manufactured by J. D. Wallace & Company, Chicago, is the saw shown in the illustration below. This machine is adapted for use in pattern, cabinet or carpenter shops, and is designed with a view to saving the time ordinarily wasted in taking material to a saw located at some distance from the bench. The machine can be operated on an ordinary electric light circuit, and therefore can be located at any convenient point with little difficulty. It has ample power to take a 2-in. cut through hard wood.



Bench Saw with Motor Drive

The saw has a table 17 in. by 20 in. equipped with a saw 7 in. in diameter, which can be raised and lowered and tilted to any angle up to 45 deg. The method used to adapt the saw for cutting at various angles is a departure from

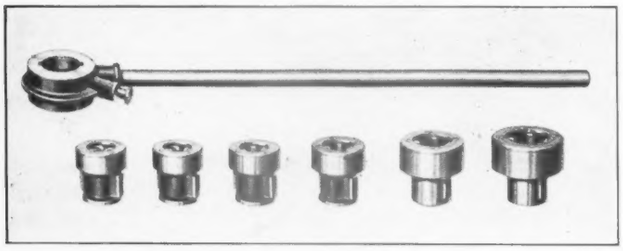
the usual practice. On this machine the table always remains horizontal, the motor and saw being tilted by means of a hand wheel and screw on the side of the machine. The advantage of this method over the usual tilting table is at once apparent. The saw can be raised or lowered so as to cut or groove any depth up to 2 in. The saw is driven through cut gears from a ½-hp. motor fitted with a ball bearing which also takes the thrust when the saw is tilted.

The cross-cut fence is adjustable to a 45 deg. angle. It is an integral part of the machine, but can be swung under the table when not in use. The rip fence is of the box type, and is clamped to the table by means of an eccentric lock. It is finished on both sides so that it can be used on either side of the saw. The saw is protected by a shutter guard which is held in place by a spring.

BEAVER SMALL PIPE THREADER

A pipe-threading tool has recently been brought out by the Borden Company, Warren, Ohio, for small pipe sizes. The dies are built on the unit plan to thread ⅛-in., ¼-in., ⅜-in., ½-in., ¾-in. and 1-in. pipe. The set may be secured complete or the units may be purchased seperately.

This tool, known as the No. 3 Beaver, Jr., consists of a



No. 3 Beaver, Jr., Pipe Threader

ratchet handle and separate die heads to thread each size of pipe. The whole outfit is packed in a convenient wooden case. The ratchet mechanism is entirely encased so that it is impossible for dirt or grease to accumulate and retard the action of the tool. The introduction of 1-in. size to the range adds greatly to the general usefulness of the tool.

NON-LIFTING INJECTOR INDICATOR

The usual form of tell-tale for non-lifting injectors warns the engineer by discharging a jet of steam into the cab when the injector blows back. An indicator has been developed by William Sellers & Company, Inc., Philadelphia, Pa., which not only performs the function of the tell-tale without discharge of steam into the cab, but in addition advises the engineer if the injector is wasting water at the overflow.

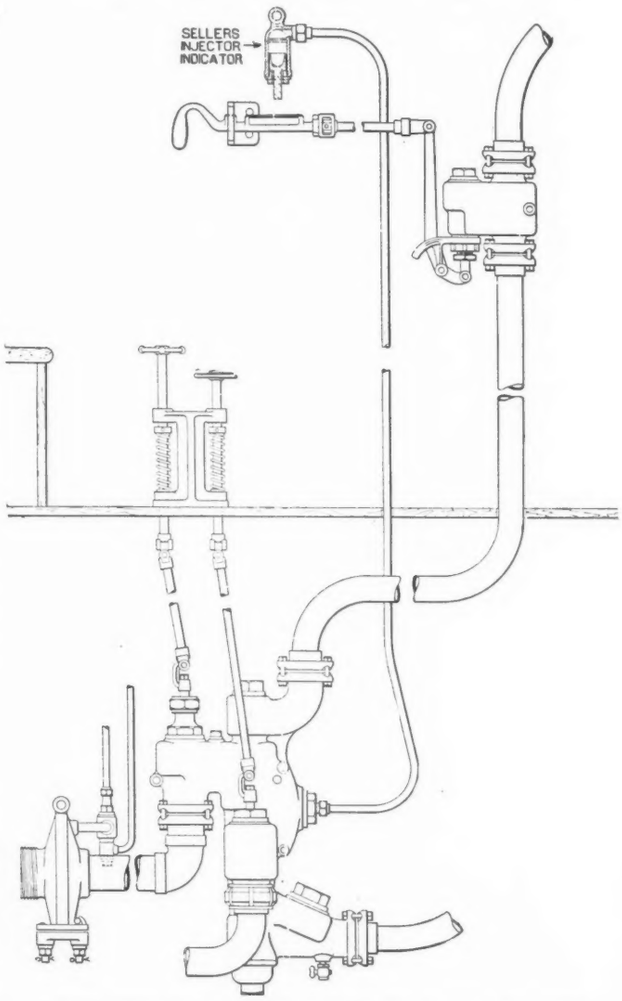
The device consists of a vertical cylinder 4 in. long, containing a loosely fitting piston, seating at each end of its stroke and provided with a projecting end, visible to the engineer when resting on its lower seat. The upper end of the cylinder is connected by a ½-in. copper wire with the overflow chamber of the injector.

Its action depends upon the well-known principle of the working of the injector, that when feeding without waste there is always a partial vacuum within the overflow chamber of an injector of the gravity overflow type. This vacuum is utilized to raise the loosely fitting piston to its upper seat, causing the projecting plug to disappear from view.

If for any cause the injector starts to waste, the vacuum within the overflow chamber is broken, the piston drops and seats at the lower end of its stroke, exposing the projecting plug. The operator is thus warned and will partially close the lazy cock, stopping the waste. If there is interruption of the water or steam supply, and the injector "flies off," the piston will instantly drop to its lower seat, preventing outflow of steam and warning the engineer of the danger.

When the injector operating valve is open, the end of the piston must always be invisible, unless heating the water in the tank. If steam is blown back into the tank in winter, the position of the projecting plug of the indicator is a continuous reminder that the injector is not operating and there may be danger of overheating the water.

A further advantage of this form of indicator is that it enables the engineer or fireman to obtain the actual minimum capacity. Most operators do not regulate the water supply closely, fearing that the injector may break off without warning or waste at the overflow. The indicator is so sensitive to conditions in the overflow chamber of the



Application of the Sellers Non-Lifting Injector Indicator

injector that the exact minimum can be obtained by regulating the lazy cock until the end of the piston appears, due to the loss of vacuum in the overflow chamber. It is claimed that a very slight opening of the lazy cock will cause the piston to rise and the exact minimum to be obtained.

The application of the indicator also will reduce the tendency of the engineer to close the heater valve, which prevents the injector from re-starting automatically. It is designed to make the non-lifting injector as safe and certain to operate as an open-overflow lifting injector.

The indicator is applicable to the Sellers, Nathan WF, Nathan Simplex, Chicago and other forms using an overflow chamber which contains the combining tube, and is closed against the atmosphere by a gravity overflow valve.

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THE RAILWAY MECHANICAL ENGINEER is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.)

The car repair shops of the Delaware & Hudson at Carbondale, Pa.—two buildings known as No. 18 and No. 20—were destroyed by fire on March 15. About 200 men are out of work temporarily. These buildings were of brick, 400 ft. long and 40 ft. wide.

In the large repair shops of the New York, New Haven & Hartford, the working time has been reduced to 40 hours a week. About 4,000 persons are affected. The Pennsylvania has reduced the working time at many shops. The Nashville, Chattanooga & St. Louis has made a reduction of 10 per cent in the forces of its large shops.

The French government, through the French High Commission, has bought from the Director General of Military Railways 485 standard gage, Pershing type locomotives now being built by the Baldwin Locomotive Works and 19,860 freight cars of various types that were under manufacture in the United States when the armistice was signed. There remains a comparatively small number of locomotives and cars yet to be disposed of and it is expected that they will be sold to some of the Allied governments.

Electric Furnace Association

At a meeting held on March 21 and 22 at Niagara Falls, N. Y., a permanent organization was formed to be known as the Electric Furnace Association, for the purpose of promoting the use of various electric furnace products. The meeting was called by Acheson Smith, vice-president and general manager of the Acheson Graphite Company, Niagara Falls. Resolutions were passed inviting all manufacturers of electric furnaces, electric apparatus, electric furnace supplies and accessories, public utility corporations, designers and inventors of electric furnace equipment and the users of electric furnaces to become members and to join in making an aggressive and thorough campaign to disseminate to engineers and the public accurate data as to the quality of electric furnace products of all kinds. The following are the officers of the association: President, Acheson Smith, Acheson Graphite Company, Niagara Falls, N. Y.; first vice-president, C. H. Booth, Booth-Hall Company, Chicago; second vice-president, W. E. Moore, Pittsburgh Electric Furnace Company, Pittsburgh, Pa.; secretary, C. G. Schlueder berg, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; treasurer, F. J. Ryan, American Metallurgical Corporation, Philadelphia, Pa.

Iron and Steel Prices Reduced

Representatives of the steel industry and the Industrial Board of the Department of Commerce at a conference in Washington during March reached an agreement on a schedule of reduced prices for the principal articles of iron and steel which will apply to all purchases by the various government departments and below which the board says the public should not expect to buy during the current year. The price schedule is of especial interest to the railroads, which are the largest purchasers of steel, and as the government is operating most of the railroads the prices will apply to purchases for railroad use. The schedule agreed upon, which is effective at once, is as follows:

	November 11 price	Present price	New price	Reductions From November 11	Reductions From present
Pig iron basic	33.00 G.T.	30.00	25.75	7.25	4.25
Billets 4-inch	47.50 G.T.	43.50	38.50	9.00	5.00
Billets 2-inch	51.00 G.T.	47.00	42.00	9.00	5.00
Sheet bars	51.00 G.T.	47.00	42.00	9.00	5.00
Slabs	50.00 G.T.	46.00	41.00	9.00	5.00
Skelp sheared	3.25 cwt.	3.00	2.65	12.00 N.T.	7.00 N.T.
Skelpt universal	3.15 cwt.	2.90	2.55	12.00 N.T.	7.00 N.T.
Skelp grooved	2.90 cwt.	2.70	2.45	9.00 N.T.	5.00 N.T.
Merchant bar—base	2.90 cwt.	2.70	2.35	11.00 N.T.	7.00 N.T.
Sheared plates	3.25 cwt.	3.00	2.65	12.00 N.T.	7.00 N.T.
Structural—base	3.00 cwt.	2.80	2.45	11.00 N.T.	7.00 N.T.
Wire rod	57.00 G.T.	57.00 G.T.	52.00 G.T.	5.00 G.T.	5.00 G.T.
Plain wire	3.25 cwt.	3.25	3.00	5.00 N.T.	5.00 N.T.
Nails	3.50 cwt.	3.50	3.25	5.00 N.T.	5.00 N.T.
Black sheets, No. 28	5.00 cwt.	4.70	4.35	13.00 N.T.	7.00 N.T.
Blue annealed No. 10	4.25 cwt.	3.90	3.55	14.00 N.T.	7.00 N.T.
Galvanized sheets No. 28	6.25 cwt.	6.05	5.70	11.00 N.T.	7.00 N.T.
Tin plate No. 100 box	7.75	7.35	7.00	15.00 N.T.	7.00 N.T.
Tubular products	3½ points off card				7.00 N.T.
Hoops—base	3.50 cwt.	3.30	3.05	9.00 N.T.	5.00 N.T.
Light rails	3.00 cwt.	2.70	2.45	11.00 N.T.	5.00 N.T.
Rails standard Bessemer	55.00 G.T.	55.00 G.T.	45.00 G.T.	10.00 G.T.	10.00 G.T.
Nails standard O. H.	57.00 G.T.	57.00 G.T.	47.00 G.T.	10.00 G.T.	10.00 G.T.
Ore	No change				

Basing points and differentials unchanged. Prices effective at once.

In view of the higher costs developed throughout the world as a result of the war a return to anything like pre-war prices was regarded as out of the question.

Civil Service Examination for Locomotive Inspector

The United States Civil Service Commission announces an open competitive examination for inspector of locomotives, for men only, on May 21 and 22, 1919. Vacancies in the Interstate Commerce Commission, and in positions requiring similar qualifications, will be filled from this examination, unless it is found in the interest of the service to fill any

vacancy by reinstatement, transfer, or promotion. The salary of the position is $3,000 per annum and necessary expenses when absent from headquarters in the discharge of official duties. Applicants must have reached their twenty-fifth but not their fifty-fifth birthday on the date of the examination, and must have not less than three years' railroad experience in the capacity of master mechanic, road foreman of engines, locomotive boiler maker, locomotive boiler inspector, roundhouse foreman, shop foreman, locomotive machinist, or locomotive engineer; or not less than five years as locomotive inspector or locomotive fireman; and must have been within three years next preceding the date of application in active service in any such capacity or in the capacity of inspector of locomotive equipment under the government of the United States or of any state or territory. Applicants should at once apply for Form 1892, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.

American Machinery in Australia

The Far Eastern Division of the Bureau of Foreign and Domestic Commerce has issued Circular No. 13 on American machinery in Australia. The report is of particular interest to readers of this paper because of the fact the railroad shops represent an important part of the market for American machine tools.

Australia, the circular says, is rapidly becoming a manufacturing country, and the demand for certain American machinery and machine tools is increasing. As a majority of the engineering establishments are also jobbing shops, the engineers in charge are averse to buying from catalogues, but desire actual demonstrations, especially of new machines, and the majority of sales are accordingly made after a sample machine has been received by the agent or importer.

The exclusive agency is accepted as the most satisfactory method of selling machinery and accessories in Australia. In a country like Australia, where vast distances must be traveled in seeking orders and where modern machinery is just being introduced, it is only fair to the agent who has stocked a machine, which may sometimes prove unsaleable, that he be protected by an exclusive contract.

Lathes are the most important essential in the machine shops which are springing up in Australia. As the majority of the work of these shops is jobbing, the machine tools should be universal. Gap lathes, for instance, permit one machine to cover a large range of work and are very popular in Australia. One American machine of this universal type has enjoyed a very large sale. Most of the American gap lathes before the introduction of this one were cheap, and light tools are not in demand.

The price of American planers as compared with that of English makes is disproportionately high. Though the American planers are very high grade with a number of automatic and convenient feeds, these conveniences have made the price too high for the Australian market, and at present there are not half a dozen of these machines in use in that country. A moderate-priced simple planer could be introduced to advantage. This is equally true of punches, shears, rolls, and other tools used in shipbuilding and structural work, our prices of which are much higher than the British.

Thirteenth Engineer (Railway) Regiment Sees Active Service

The 13th Engineers Regiment, composed of railway men on roads running west from Chicago, which has been operating military railroads back of Verdun was scheduled to leave Fleury-sur-Aire on March 7, on the way to an embarkation port preliminary to its return home. According to a cable published in the Chicago Daily News, on March 6, it has the distinction of being the first American Engineer Regiment to enter active service in the war, and has an excellent record for the handling of men and supplies, and for the assistance given in the preparation for the American drive on the Meuse-Argonne.

Although engineer regiments are generally classed as noncombatant units, the 13th has been classed as a combat unit in orders from the American and French headquarters, with the instructions that on the discharge papers of each officer and man the words, "Took part in the Champagne, St. Mihiel and Meuse-Argonne offensives," be inserted. Another distinction of the 13th is the insignia of a blue square cloth patch with a red engineer castle in the center, surrounded by a circle of 13 white stars, which indicates the beginning of the American nation and the start of the American expedition. Usually a division is the smallest unit that has its own shoulder insignia.

On October 18, 1917, the 13th took over the operation of the railroads in the French advanced zone and was relieved on February 28, 1919. At the end of 1918 it had moved 1,777 trains, carrying millions of men, including many who were wounded, and 9,230,080 tons of freight, as well as the private trains of President Poincare, General Pershing, Secretary Baker and others. The 13th was operating, on the day the armistice was signed, 229 kilometers (138 miles) of track supplying the Argonne, Verdun and St. Mihiel fronts.

As part of the railroad was within range of the German artillery and all of it within range of heavy explosives and machine guns of airplanes, the men were obliged to run the trains and repair the track under constant fire. Twenty-four immense railroad guns were firing along this line. One track was used for ammunition and the other for supplies.

Several members of this regiment received special recognition. In his letter forwarding the decorations, General Pershing said: "The cheerfulness, adaptability, loyalty and self-sacrificing devotion to duty uniformly displayed under trying circumstances by officers and men from the regimental commander to the most recently arrived private have added a new luster to the traditions of our railway service."

MEETINGS AND CONVENTIONS

International Railway Fuel Association.—The next annual convention of the International Railway Fuel Association will be held at the Hotel Sherman, Chicago, from May 19 to May 22.

American Foundrymen's Association.—The 1919 convention and exhibit of the American Foundrymen's Association will be held in Philadelphia, Pa., from September 29 to October 4. It is planned to make this convention an international one and invitations will be sent to foundrymen and industrial engineers all over the world. Details of the program will be announced later.

June Mechanical Convention Exhibits.—The Railway Supply Manufacturers' Association announces that at the assignment of space in Pittsburgh, February 14, there was sold and assigned over 80,000 sq. ft. The available space is a trifle less than 89,000 sq. ft., leaving less than 10 per cent for such exhibitors as will come in. This available space includes all of the space heretofore used in previous years together with a number of additions, which the committee found possible to use. The committee is looking over the pier with a view of providing additional space if possible, as indications are that it can be sold to exhibitors if provided. Edmund H. Walker, president of the association, in announcing the above, says that "the success of the June meeting from an exhibition standpoint is assured."

General Foremen's Association.—The annual convention of the International Railway General Foremen's Association will be held at the Hotel Sherman, Chicago, September 2, 3, 4 and 5. The topics to be discussed are as follows:

1. Welding of locomotive cylinders and other autogenous welding.

2. Safety first in shop and engine house service. The best method of application so that employees may be interested to practice same.

3. Draft gears.

The association has received permission from the Railroad Administration to hold this convention and due to the conditions on the railways at the present time a large attendance is to be desired from both the locomotive and car departments.

American Welding Society.—An association known as the American Welding Society was organized at the Engineering Societies building, New York, on March 28, 1919. This society is a merger of the welding committee of the Emergency Fleet Corporation and the National Welding Council, and its purpose is to provide a disinterested and dependable source of information on welding, not only for the benefit of the manufacturers of welding apparatus and supplies, but also to aid those who use welding in their production and those who purchase welded goods. The society will bring together in the manner usual for scientific societies persons from all branches of the industry who may be interested in any of the welding processes. It is proposed that the society will create and assist in maintaining a Bureau of Welding which will be a separate organization designed to take advantage of the principle of co-operation in research and standardization. The American Bureau of Welding will consist of a joint board of directors, 30 from the American Welding Society and one each from the various scientific and engineering societies, including the American Railway Association, and one each from the United States Commerce, Navy and War Departments and the United States Shipping Board.

Membership in the American Welding Society is divided into five classes: Class A, sustaining members, annual dues $100; open to one or more representatives from each corporation interested. Class B, annual dues $20; open to individuals who may or may not be employed by corporations, and to consulting engineers, college professors, etc. Class C, annual dues $10; open to members of existing societies which will become affiliated with the new society through the proposed Bureau of Welding. Class D, annual dues $5; open to welding artisans. Class E, open to trade associations, putting them in the same category as corporations. Class F, honorary members. Class C and D memberships do not carry the privilege of voting or holding office.

The activities of the society will include the promotion of research work on problems of common interest to all or groups of the membership, including the financing of such projects; the consideration of questions of standardization, which it is proposed shall be handled in co-operation with the American Engineering Standards Committee through the agency of the Welding Bureau; the exertion of a steadying and unifying influence on legislation affecting welding by supplying law makers with authentic information, and the study of proper methods of training autogenous welders.

It is reported that already a large number of corporations and engineers are interested in the project, including officers and members of many of the national technical and engineering societies, universities and engineering schools, government departments and bureaus, gas and electric welding companies, and shipbuilding, steel and automobile companies.

The following officers were elected:

President—C. A. Adams, President American Institute of Electrical Engineers, Cambridge, Mass.
Vice-President (for 1 year)—J. M. Moorehead, Union Carbide Company, New York.
Vice-President (for 2 years)—G. L. Brunner, Brunner Manufacturing Company, Utica, N. Y.
Directors for 1 year—
W. M. Beard, Linde Air Products Company, New York.
M. H. Roberts, Air Reduction Sales Company, New York.
M. M. Smith, Commercial Acetylene Company, New York.
L. D. Lovekin, American International Ship Building Corp., Philadelphia, Pa.
Alexander Churchward, Wilson Welder and Metals Company, New York.
W. H. Patterson, Westinghouse Electric & Mfg. Company, Pittsburgh, Pa.
Walter J. Jones, Chester Shipbuilding Company, Philadelphia, Pa.
C. A. McCune, Page Steel & Wire Company, New York.
Directors for 2 years—
R. R. Browning, Oxweld Acetylene Company, New York.
A. S. Kinsey, Professor of Experimental Mechanics, Stevens Institute, Jersey City, N. J.
Victor Mauck, John Wood Manufacturing Company, Conshohocken, Pa.
E. L. Hirt, Bethlehem Shipbuilding Corporation, South Bethlehem, Pa.
J. F. Lincoln, Lincoln Electric Company, Cleveland, Ohio.
H. M. Hobart, General Electric Company, Schenectady, N. Y.
D. C. Alexander, Quasi Arc Weldtrode Company, New York.
H. R. Swartley, Jr., Davis-Bournonville Company, Jersey City, N. J.
Directors for 3 years—
L. H. Davis, Linde Air Products Company, New York.
E. L. Mills, Air Reduction Sales Company, New York.
D. B. Rushmore, General Electric Company, Schenectady, N. Y.
James Burke, Burke Electric Company, Erie, Pa.
D. H. Wilson, Jr., Wilson Welder & Metals Company, New York.
Hermann Lemp, General Electric Company, Erie, Pa.
C. J. Nyquist, Torchweld Company, Chicago, Ill.
Alexander Jenkins, Alexander Milburn Company, Baltimore, Md.

It was voted that the charter should be held open for ten days, and that those applying for membership in the society before April 8 should be considered charter members.

At a meeting of the directors in the afternoon, W. E. Symons, Galena Signal Oil Company, Franklin, Pa., was appointed treasurer, and H. C. Forbes, consulting engineer, New York City, was appointed secretary.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations:

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City. Convention, May 6-8, 1919, Chicago.

AMERICAN RAILROAD MASTER TINNERS' COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—O. E. Schlink, 485 W. Fifth St., Peru, Ind.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—V. R. Hawthorne, 746 Transportation Bldg., Chicago. Convention, June 23-25, 1919, Atlantic City, N. J.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—R. D. Fletcher, Belt Railway, Chicago.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 Lawlor Ave., Chicago. Meetings second Monday in month, except June, July and August, Hotel Morrison, Chicago.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—W. R. McMunn, New York Central, New York, N. Y.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, C. H. & D., Lima, Ohio.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. G. Crawford, 542 W. Jackson Blvd., Chicago. Convention May 19-22, 1919, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabasha Ave., Winona, Minn. Convention September 25, Hotel Sherman, Chicago.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York. Convention May 26-29, Hotel Sherman, Chicago.

MASTER CAR BUILDERS' ASSOCIATION.—V. R. Hawthorne, 746 Transportation Bldg., Chicago. Convention, June 18-21, Atlantic City, N. J.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION OF U. S. AND CANADA.—A. P. Dane, B. & M., Reading, Mass.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgrebe, 623 Brisbane Bldg., Buffalo, N. Y.—Meetings, third Wednesday in month, Statler Hotel, Buffalo, N. Y.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. R. R., Cleveland, Ohio.

RAILROAD CLUB MEETINGS

Club	Next Meeting	Title of Paper	Author	Secretary	Address
Canadian	Apr. 8	Car Trucks	W. J. Hyman	James Powell	P. O. Box 7, St. Lambert, Que.
Central	May 9	Railroad Power Plants	William Olsen	H. D. Vought	95 Liberty Street, New York.
Cincinnati	May 13	Fuel Conservation	D. E. Dick	H. Boutet	101 Carew Building, Cincinnati, O.
New England	Apr. 8	Track Maintenance		W. E. Cade, Jr.	683 Atlantic Ave., Boston, Mass.
New York	Apr. 18	Address by W. T. Tyler		H. D. Vought	95 Liberty Street, New York.
Pittsburgh	Apr. 24			J. D. Conway	515 Grandview Ave., Pittsburgh, Pa.
St. Louis	Apr. 11	Proper Loading and Handling of Live Stock.—Election of Officers	W. J. Embree	B. W. Frauenthal	Union Station, St. Louis, Mo.
Western	Apr. 21			A. F. Stuebing	750 Transportation Bldg., Chicago.

PERSONAL MENTION

GENERAL

H. P. ANDERSON, superintendent of motive power of the Missouri, Kansas & Texas, at Parsons, Kan., has been appointed mechanical superintendent of the Missouri, Kansas & Texas and affiliated lines, with office at Denison, Tex.

M. K. BARNUM, assistant to general superintendent maintenance of equipment of the Baltimore & Ohio, with office at Baltimore, Md., has been appointed mechanical engineer for the corporation.

C. J. BODEMER, division master mechanic of the Louisville & Nashville, with office at Albany, Ala., has been appointed assistant superintendent of machinery, with headquarters at Louisville, Ky., succeeding Millard F. Cox, resigned to engage in other business.

E. W. PRATT, assistant superintendent of the motive power and car departments of the Chicago & North Western, with headquarters at Chicago, retired from active service on March 1, and was granted an extended leave of absence. Although only 50 years of age, Mr. Pratt has served the Chicago & North Western for nearly 30 years, starting as a message boy and telegraph student when 14 years old, then working in the engineering department and on construction work to earn money to enable him to complete a course of mechanical engineering at Lehigh University, where he also specialized in chemistry and metallurgy. Having had practical work in both civil and mechanical engineering, Mr. Pratt specialized in electrical engineering for one year with the Western Electric Company of Chicago, and again entered the employ of the Chicago & North Western as general air brake inspector and instructor, being promoted successively to enginehouse foreman, general foreman, master mechanic and assistant superintendent of the motive power and car departments, in which latter capacity he has remained ten years. Mr. Pratt has been active in railway association work, having been president of the Western Railway Club, Chicago, in 1914-15; president of the American Railway Master Mechanics' Association in 1915-16 and president of the International Railway Fuel Association in 1917-18.

E. W. Pratt

R. W. BURNETT, superintendent motive power of the Missouri, Kansas & Texas of Texas at Denison, Texas, has been appointed assistant mechanical superintendent of the Missouri, Kansas & Texas and affiliated roads, with office at Denison.

E. B. HALL, assistant superintendent of the Wisconsin division of the Chicago & North Western, with headquarters at Milwaukee, has been appointed assistant superintendent of the motive power and car departments of the road, with headquarters at Chicago, to succeed E. W. Pratt, who is on leave of absence.

W. H. MADDOCKS has been appointed mechanical engineer of the Missouri, Kansas & Texas and affiliated roads, with office at Parsons, Kan.

T. O. SECHRIST, general master mechanic of the Louisville & Nashville, with office at Louisville, Ky., has been appointed assistant superintendent of machinery and the position of general master mechanic has been abolished.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

G. H. BERRY has been appointed master mechanic of the Knoxville and Atlanta divisions of the Louisville & Nashville, with headquarters at Etowah, Tenn., succeeding W. E. Hunter.

CLYDE L. BUNCH, whose appointment as master mechanic of the Southern Railway, with headquarters at Sheffield, Ala., was announced in these columns last month, was born in Wake county, N. C., on February 14, 1878, and received a high school education. In the summer of 1902 he entered the employ of the Richmond, Fredericksburg & Potomac as a machinist at Richmond, Va., resigning in the summer of 1904 to accept a similar position with the Chesapeake & Ohio. On March 1, 1905, he went to the Southern Railway as a machinist in the Spencer, N. C., shops, was promoted to gang foreman there in April, 1909, erecting shop foreman on October 1, 1909, and since January 1, 1913, until he was appointed master mechanic, acted as shop superintendent at Spencer.

C. L. Bunch

W. E. HUNTER, master mechanic of the Knoxville and Atlanta divisions of the Louisville & Nashville, at Etowah, Tenn., has been transferred to the Cincinnati Terminals and Kentucky division, with office at Covington, Ky., succeeding C. W. Mathews.

C. W. MATHEWS, master mechanic of the Cincinnati Terminals and Kentucky division of the Louisville & Nashville, with office at Covington, Ky., has been transferred to the Albany (Ala.) shops, succeeding C. J. Bodemer, assigned to other duties.

CAR DEPARTMENT

RICHARD W. MOORE, general car foreman on the Canadian National at Cochrane, Ont., has been promoted to district car foreman, with headquarters at Saskatoon, Sask. He was born at Listowel, Ont., on October 20, 1882, and received his education in the Brandon high school of that place. He entered railway service in July, 1906, as a car repairer on the Grand Trunk Pacific, which position he held for two years when he was promoted to car foreman, serving in that capacity for nine years at Melville, Sask., Rivers, Man., and Fort William, Ont. When the National Transcontinental was taken over by the Canadian government, Mr. Moore was transferred to that road as car foreman. In November, 1917, he was appointed general car foreman, with headquarters at Cochrane, Ont., which position he held until his recent appointment as district car foreman of the Canadian National, with headquarters at Saskatoon.

PURCHASING AND STOREKEEPING

J. M. VELASCO, local purchasing agent of the National Railways of Mexico, at New York, has been appointed assistant to the general purchasing agent, with office at Mexico City, Mex., and F. P. de Hoyos, general agent of the traffic department, at New York, is now also local purchasing agent, with office at New York.

A. E. Cox, whose appointment as general steorkeeper of the Canadian National, Western Lines, with headquarters at Winnipeg, Man., was announced in the *Railway Mechanical Engineer* last month, was born at Huddersfield, Eng., in 1863, and received his education in private schools at Hamburg, Germany, and college at Huddersfield. Mr. Cox first entered railway service in 1883 as timekeeper on the Canadian Pacific Western division, with headquarters at Moose Jaw, Sask., which position he held for four years, when he was appointed chief clerk in the stores department of the Manitoba & Northwestern. In 1893 he was appointed storekeeper when the Manitoba & Northwestern was absorbed by the Canadian Pacific, and the following two years was assistant to the superintendent of construction of the Ontario and Rainy River section of the Canadian Northern. Since 1912 he was storekeeper of that road, until his recent appointment on the Canadian National.

A. E. Cox

GEORGE W. SNYDER has been appointed general storekeeper of the Pennsylvania Railroad, eastern lines, with headquarters at Philadelphia, Pa. Mr. Snyder was born at Pottsville, Pa., on January 9, 1866, and was educated in the public schools of Pottsville and at Lehigh University. Mr. Snyder began railway work with the Pennsylvania Railroad on November 1, 1884, as rodman on the Renovo division. He was appointed assistant supervisor of the same division on January 1, 1886, and in August, 1890, was promoted to supervisor. On June 10, 1897, he was appointed supervisor on the Northern Central at Baltimore, and three years later was transferred to the Altoona yard. He was promoted to division engineer of the Monongahela division in January, 1901, and in June, 1903, was transferred to the Pittsburgh division. On April 1, 1907, he was appointed principal assistant engineer of the Western Pennsylvania division; in October, 1917, he was made assistant engineer, maintenance of way, in charge of bridges and structures, and served in that position until his recent appointment as general storekeeper.

G. W. Snyder

SUPPLY TRADE NOTES

J. J. Haigh has been appointed assistant district manager of sales for the Chicago Pneumatic Tool Company, with headquarters at 175 First street, San Francisco, Cal.

Nelson B. Gadch has been appointed district manager of sales for the Chicago Pneumatic Tool Company, with headquarters in the Metropolitan Bank building, Minneapolis, Minn.

The A. Gilbert & Sons Brass Foundry Company, St. Louis, Mo., recently installed a complete chemical laboratory at its plant and all products are now made under chemical supervision.

Fred H. Waldron, Minneapolis representative of the Chicago Pneumatic Tool Company, has been appointed manager of the pneumatic tool sales division, to succeed J. D. Osgood, who has resigned.

The Dearborn Chemical Company, Chicago, announces the opening of offices in the Commerce Trust building, Kansas City, Mo. E. M. Massen and W. H. Fairlamb will make their headquarters at that office.

John W. Foyle, vice-president of the Gustin-Bacon Manufacturing Company, Kansas City, Mo., who has been a major in the United States Army, has been released from service and has returned to his duties with his company.

Frank G. Wallace, vice-president of the Canadian Locomotive Company, has been elected president to succeed the late Dr. J. J. Harty, who died in London on February 23. J. L. Whiting succeeds Mr. Wallace as vice-president.

Clyde P. Benning, service manager of Mudge & Company, Chicago, has been appointed assistant general manager with headquarters at Chicago, in which position he will assist the railroad companies in developing motor car organizations.

J. E. Slimp, who has for many years been connected with the sales department of the Ohio Brass Company, Mansfield, Ohio, has resigned to become associated with H. C. Dodge, of Boston, who is at the head of several manufacturing companies in New England.

J. I. Edwards has been appointed manager of the rock drill sales division of the Chicago Pneumatic Tool Company, succeeding K. Eklund, who has been appointed special foreign representative, and who will leave shortly for Europe in the interest of that company.

J. A. Farris, who has been connected with the Whiting Foundry Equipment Company, at Chicago, as crane engineer in the engineering department for the past 10 years, has entered the employ of Scully-Jones & Co., at Chicago, as special sales engineer on cranes.

The controlling interest of the Carroll Foundry & Machine Company, Bucyrus, Ohio, manufacturers of locomotive cranes, has been purchased by Cleveland interests, and a temporary organization has been perfected which will be taken over later when the company is reorganized.

C. E. Hague, formerly production engineer of the Mid-West Engine Company, Indianapolis, Ind., has been appointed sales manager of the American Steam Conveyor Corporation, Chicago, manufacturers of the American steam ash conveyor and other ash handling equipment.

Lieutenant Sherman C. Amsden, formerly connected with Mudge & Co., Chicago, has been appointed assistant to the president, in which position he will have charge of publicity, special sales plans, and investigations. Upon his honorable

release from the service he returned to Mudge & Co. to become assistant to the president.

The Chicago Pneumatic Tool Company announces the removal of its Boston, Mass., office to 182 High street. F. F. Eggleston, district manager of sales, will represent the company in that territory. The company also announces the opening of offices and warehouses at Tulsa, Okla.

Malcolm L. Maclean, formerly manager of sales, miscellaneous department, of the American Steel Foundries, with headquarters at Chicago, and until recently a major in the infantry, has been appointed manager of sales of the Duquesne Steel Foundry Company, at Pittsburgh, Pa.

Jean K. Vanatta, mechanical engineer of Mudge & Company at Chicago, has been appointed service manager, in which capacity he will have charge of the company's service engineers, who are working with the motor car men on the various railroads throughout the country, as well as the developing of the service idea.

The Bridgeford Machine Tool Works and the Betts Machine Company of Rochester, N. Y., announce the opening of joint branch offices in New York and Chicago. The New York office is located at 50 Church street, in charge of F. C. Severin, and the Chicago office is at 549 Washington boulevard, in charge of A. W. Van Buren.

General Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, was recently decorated with the United States government distinguished war service medal, which was awarded him for his work in systematizing methods and practices in industries producing ordnance material for the army.

A. N. Willsie has resigned from the Chicago, Burlington & Quincy, with which company he has been connected for the past 29 years, to accept the position of district engineer of the Locomotive Stoker Company, with headquarters at Chicago. Mr. Willsie was born in Galesburg, Ill., where he received his primary school education. He entered the service of the Burlington on April 20, 1880, as an errand boy in the master mechanic's office, and later filled the position of chief clerk to the master mechanic in the same office. In 1890 he became a locomotive fireman, and then was engineman for six years when he became road foreman of engines, from which position he was promoted to division master mechanic at Brookfield, Mo., Aurora, Ill., and Omaha, Neb. Mr. Willsie left the mechanical department to take the position of division superintendent in the operating department, and for two years filled this position at St. Joseph, Mo., and three years at Hannibal, Mo. Since June, 1912, Mr. Willsie has been permanent chairman of the fuel economy committee and superintendent of fuel economy of the Burlington, with headquarters in Chicago, reporting direct to the general superintendent of motive power, and vice-president in charge of operation.

A. N. Willsie

Edwin Besuden has been appointed eastern district manager of the railway department of the Chicago Varnish Compeny, in charge of steam and electric railway sales. His headquarters are at 50 Church street, New York. Mr. Besuden was formerly sales manager of the Jewett Car Company and was connected with that company for 16 years.

The Pollak Steel Company announces that the G. F. Cotter Supply Company, Houston, Texas, will represent it as Southwestern sales representative. They will endeavor to sell the products, consisting of forgings of all kinds, axles, locomotive parts, as well as the Pollak special heat treated products. This covers the material produced both at the Cincinnati as well as the Chicago works.

The Universal Car Seal & Appliance Company, Lyon Block, Albany, N. Y., has recently been reorganized and has changed its name to the Universal Seal Corporation. It has moved its offices and manufacturing headquarters to 270-276 Hudson avenue, Albany, N. Y. The new officers are as follows: C. R. Martineau, president; Gardner C. Leonard, vice-president; Edward J. Fitzsimmons, Jr., treasurer; William C. Martineau, secretary.

John B. Canfield, who since March 1 has been associated with the Harley Company of Springfield, Mass., as special representative and counsel, commenced work in mechanical lines with the Boston & Albany, at Boston, Mass., in 1885, as machinist apprentice. He continued with the railroad as foreman machine shop, general foreman locomotive department and master mechanic of the Albany and Boston divisions, severing his connection with railroad work in 1916, after a continuous service of 30 years. In 1906, while in the railroad service as master mechanic at Boston, Mass., Mr. Canfield enrolled as a law student in the Boston Evening Institute, now the Northeastern College of Law, graduating in June, 1910, with the degree of LL.B., and was admitted to the Massachusetts bar September 23, 1910. At the time of his coming to the Harley Company, he was actively engaged in the practice of his profession at Springfield, Mass. During the war he served as major of engineers, and was commanding officer of the Sixth Battalion, 21st Engineers, being honorably discharged in January of this year.

J. B. Canfield

Arthur F. Braid has been appointed sales manager of the metal and alloy department of the Metal & Thermit Corporation, New York. Mr. Braid went to the company seven years ago as a traveling salesman, and after a few years of service in this capacity was appointed assistant superintendent of the Jersey City plant, in charge of the manufacture of carbonfree metals and alloys. When the United States entered the war, he assumed active charge of metal sales at the New York office of the company.

C. W. Johnson has been appointed assistant manager of works of the Westinghouse Electric & Manufacturing Company. After graduating from Ohio State University, Mr. Johnson entered the employ of the Steel Motor Company of Johnstown, Pa. A year later he became associated with the Bullock Electric Company, of Cincinnati, Ohio, and in 1904 was made superintendent of Allis-Chalmers-Bullock, Ltd., of Montreal, Can. In 1907 he entered the employ of the Westinghouse company, being appointed chief inspector of

works, in which capacity he served until his recent appointment.

George K. Heyer is the new assistant telephone sales manager of the Western Electric Company, having been advanced from the position of railway sales engineer. He has been an employee of the company since 1902, and always has been in New York. He will remain there as his headquarters will be at 195 Broadway. E. V. Adams succeeds G. K. Heyer as railway sales engineer. He has been a Western Electric man since 1910, when he began in the railway sales department of the Chicago house. He was transferred to St. Louis in 1912, and the following year went to New York, where his headquarters will remain.

P. Harvey Middleton, executive assistant of the Railway Business Association, was invited by Señor M. Muñoz, general superintendent of the Mexican National Railway Administration, during his visit to New York recently, to make a trip with him over all the lines under the control of the Carranza government. Mr. Middleton has accepted the invitation and will leave for Mexico shortly. He will be met at Laredo, Texas, by Señor Muñoz and will visit all points of interest, including the steel mills and railway machine shops. Mr. Middleton speaks Spanish, which will aid him greatly in his investigations.

Wilson W. Butler, whose appointment as president of the Canadian Car & Foundry Company, Ltd., the Canadian Steel Foundries, Ltd., and the Pratt & Letchworth Company, Ltd., Canada, was announced in the *Railway Mechanical Engineer* last month, was born at Danville, Ohio, on December 9, 1862, and received his early education in the Danville Select School. Mr. Butler began his business career with the John Shillito Company, at Cincinnati, Ohio, and later was appointed western manager of the Sterlingworth Railroad Supply Company, at Chicago. Subsequent to his appointment as president of the Canadian Car & Foundry Company, Mr. Butler served as western sales agent of the American Car & Foundry Company, at Chicago; second vice-president and director of the Simplex Railway Appliance Company, at New York, and second vice-president and director of the American Steel Foundries, at New York. In 1901, as vice-president and director of the Simplex Railway Appliance Company, he established the manufacturing plant of that company in Montreal, Que. He was also vice-president and director of the Dominion Steel Car Company, near Montreal, where the first steel car manufactured in Canada was built. Mr. Butler was instrumental in the organization of the Canadian Car & Foundry Company, Ltd., composed of the Dominion Car & Foundry Company, the Canada Car Company and the Rhodes Curry Company. Since shortly after the beginning of the war, the plants of the companies of which Mr. Butler is president have been engaged in the production of steel, and the forging and machining of shells, for the American, British and Russian governments. Mr. Butler succeeds Senator N. Curry, who has retired from the presidency of the companies, and now holds the position of chairman of the board of directors.

W. W. Butler

Samuel T. Fulton, vice-president of the Railway Steel Spring Company, died in New York on March 29, at the age of 52 years. He was born in Topeka, Kan., and spent many years in railroad service in the west, becoming assistant to the president of the Chicago, Rock Island & Pacific in 1904. In 1909 he became associated with the spring corporation.

Lieut.-Colonel Merril G. Baker has been elected president of the American International Steel Corporation, effective April 1. Colonel Baker was formerly assistant manager of sales of the Cambria Steel Company and has been for many years one of J. Leonard Replogle's right hand men. He succeeds the late Edward M. Hagar, who died over a year ago. The American International Steel Corporation is the steel exporting subsidiary of the American International Corporation.

At the annual meeting of the stockholders of the Westinghouse Air Brake Company, held March 31 at the general office of the company in Wilmerding, Pa., A. L. Humphrey, who has been vice-president and general manager of the company since 1909, was elected president, succeeding John F. Miller. This action was taken at the solicitation of Mr. Miller, who after a service of 30 years, during which period he rose from the position of real estate agent for the company to its highest executive office, is desirous of being relieved of some of the active duties in the management of the air brake interests. He will remain, however, a member of the board of directors and hold the position of vice-chairman of the board, with H. H. Westinghouse as chairman.

The Onondaga Steel Company, Inc., Syracuse, N. Y., announces the addition to its board of directors of Morton D. Whitford, treasurer of the Semet-Solvay Company, and Charles H. Canfield, general auditor of the Onondaga Steel Company. The company is planning to remove its offices and remaining furnace and melting equipment this spring from its original plant in Syracuse to a large tract of land it recently acquired at Eastwood on the outskirts of Syracuse, and plans have been made for the immediate construction of a large temporary office building and an addition to the main building, 40 ft. by 40 ft., which will house the blacksmith shop and the small hammer shop.

W. J. Austin, general manager of The Austin Company, industrial engineers and builders, Cleveland, Ohio, has just returned from a three-months' trip to France, Belgium and England. Mr. Austin, in company with J. K. Gannett, export sales manager of the Austin Company, sailed from New York City on December 5. The party which included Alvin T. Fuller, member of Congress from New England, were for a time the guests of the British government and were taken on a thousand-mile trip over the battlefields. The 13 buildings which were erected by the American forces for the U. S. Army Transport Service, under the Austin Company's supervision, were inspected by the party. The first building was erected at St. Nazaire by the 17th Engineers in December, 1917, and the remaining buildings were erected at Verneuil.

H. A. Jackson, president of the Chicago Pneumatic Tool Company, Chicago, returned February 19 from England, where he has been inspecting the foreign plants of the corporation. The Consolidated Pneumatic Tool Company, Ltd., and the Pneumatic Tool Company (respectively the selling agency and the manufacturing corporation), subsidiaries of the Chicago Pneumatic Tool Company in England, were found to be in excellent condition. During the war the company made some profit manufacturing bayonets for the British government while carrying on its regular tool business to capacity. News of the disposition of the International Compressed Air & Electric Company of Berlin, Germany, which the Chicago Pneumatic Tool Company owns, has not yet been received, although Mr. Jackson has been striving for a year to get word of this property.

CATALOGUES

TIME ZONES.—A large calendar and wall map of the United States and the greater part of Canada, 28 in. by 40 in., is being issued by the Metal & Thermit Corporation, New York, the map showing the new railroad time zones in the United States, which went into effect on January 1, 1919.

WELDING.—Two small folders have been issued by the Air Reduction Sales Company, New York, showing benefits derived from the use of their products and methods, one illustrating the results of repairing a badly damaged locomotive cylinder by Airco methods, and the other showing the Airco process of building up worn frogs.

ROLLER BEARINGS.—The distinctive features, together with price lists for the different sizes of its type "C" roller bearings, which are recommended for use under conditions of medium loads at medium speeds, such as inspection cars, baggage trucks, etc., are set forth in bulletin No. 1004, issued by the American Roller Bearing Company, Pittsburgh, Pa.

OVERHEAD CARRYING SYSTEMS.—Catalogue 50, issued by the Coburn Trolley Track Manufacturing Company, Holyoke, Mass., manufacturers of overhead carrying systems for both "round trough" and I-beam, shows price lists, illustrations, plans and dimension drawings of overhead carriers and their details. The catalogue contains 56 pages, 8½ in. by 11 in. and illustrates a number of actual installations.

PIPE THREADING MACHINERY.—An illustrated catalogue of pipe threading and cutting machines and pipe and nipple threading machines has been issued by the Landis Machine Company, Inc., Waynesboro, Pa. The catalogue contains a detailed discussion of all the machines, but aims principally to set forth the distinctive features of the Landis die and chaser as compared with other types. This is known as catalogue No. 25 and copies may be had upon request.

TWIST DRILLS, REAMERS, ETC.—A machinists' supply catalogue, No. 91, listing carbon and high speed twist drills and reamers, screw and drop forged wrenches, spring cotters and keys, etc., has been issued by the Whitman & Barnes Manufacturing Company, Akron, Ohio. The catalogue contains 183 pages and a distinctive feature of it is a thumb index marked to show the products listed in the various sections, making it an easy matter to find desired information.

PUMPING MACHINERY.—The National Transit Company, Oil City, Pa., manufacturers of special machinery to meet the requirements of pipe line companies, have begun the manufacture of other machinery for general service, including pumping machinery, gas and oil engines, which together with old lines are illustrated and described in various bulletins. These have been bound in heavy manila covers in such a way that others may be added from time to time as they are issued.

DRILLS AND REAMERS.—The Clark Equipment Company, Buchanan, Mich., lists and briefly describes all of the standard tools comprising the Celfor line in catalogue No. 16. These include drilling and reaming tools of various kinds, drill chucks, drill sockets, lathe tool holders, tool bits, flue cutters and drill gages. In the back of the book are several pages of tables showing feeds and speeds for Celfor drills and decimal equivalents in inches of millimeters and fractions of an inch.

SLOTTING MACHINES.—Latest information on three types of Newton slotting machines in a variety of sizes is given by the Newton Machine Tool Works, Inc., Philadelphia, Pa., in catalogue 49-A. This catalogue also contains photographs and brief specifications of upright generating planers, cold saw cutting off machines, locomotive link grinding machines, horizontal milling machines, vertical milling machines, rotary planers, keyseat milling machines and duplex locomotive rod boring machines.

SHOP PRODUCTION.—"The Missing Link" is the title of a 16-page booklet issued by the Gisholt Machine Company, Madison, Wis., explaining the principle of the Periodograph and the advantages to be secured from its installation. This machine was developed to make it possible to secure an accurate record of the time actually spent in producing, and the time lost by workmen waiting for materials, broken machines, lack of power, and other causes of delay. The booklet shows several cards which are used for registering the time lost, with the reasons, and a chart showing the record of a machine for an entire year.

BALDWIN LOCOMOTIVES.—In September, 1918, the Baldwin Locomotive Company completed the erection of its fifty-thousandth locomotive, which is the subject of Record No. 91. This locomotive is one of a group of 12 built for the Southern Railway Company and is of the Mallet articulated type with 2-8-8-2 wheel arrangement. The booklet gives some interesting facts regarding the Southern Railway System and a brief review and several illustrations of motive power built by the Baldwin Locomotive Works for this road, in addition to a description of the 12 Mallet locomotives represented by locomotive No. 50,000. It also contains interesting information regarding the growth of the locomotive industry and of the Baldwin Locomotive Company's plants, illustrations showing the shop in which the first Baldwin locomotives were constructed and the various plants in operation at the present time.

PERFORATED METALS.—The Hendrick Manufacturing Company, Carbondale, Pa., manufacturers of perforated metals, etc., has issued a catalogue of 127 pages which will be found useful for reference purposes to the user of perforated metals. Thirty-six pages are devoted to reproductions of standard perforated screen plates and 25 pages to illustrations of manufactured screens for various purposes in handling coal, cement, ore, etc., including strainers for locomotives and metal spark arresters for locomotive front ends. This company also manufactures elevator buckets, conveyor troughs and flights, stacks, tanks, hoppers, etc., which are also listed in this catalogue. Of special value should be found the tables showing the styles and sizes of perforations and the spaces between holes and maximum widths and gages in steel, according to the United States standard gage, and a number of tables of weights, measures, and gages for coal screens, decimal equivalents, metric conversion tables, etc.

CAR HEATING DEVICES.—The Gold Car Heating & Lighting Company, New York, has issued circulars describing the construction and operation of car heating apparatus which the company has recently developed. These are a vapor valve, No. 1112, designed for application on the inside of the car; packless end valve No. 1126, with automatic drip in the valve itself; packless quick opening single and twin supply valves, Nos. 1140 and 1145, respectively, which open and close on a quarter turn; and pop valve No. 1137, a train line safety valve designed to prevent the blowing off of the steam hose in case of excess pressure and also successfully used as a safety valve for hot water circulating systems. Circulars have also been issued describing other Gold devices, including a combination gasket tool No. 1077, for use in applying and removing coupler gaskets; a pressure regulator with a large steam capacity for long passenger trains, No. 1014; steam hose coupler, No. 804-S, with oscillating gasket; and steam hose coupler gasket G-4, for use in steam hose couplers using non-oscillating gaskets.